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THE SPECULATIVE BASIS OF MODERN PATHOLOGY. JAHN, VIRCHOW AND THE PHILOSOPHY OF PATHOLOGY.

WALTER PAGEL*

To Professor Max Neuburger as a Belated Gift on His 75th Birthday
(8. 12. 1944)

INTRODUCTION.

As far back as 1903 Julius Pagel (1851-1912) drew attention to parallels between ideas of an exponent of "Naturphilosophie" ("Romantic Medicine") and those commonly attributed to modern pathology. In an appreciation of Salomo Levy Steinheim (1789-1866) as a physician and scientist [1] he emphasised that romantic speculation did not prevent Steinheim from carrying out painstaking zoological and embryological research and from elaborating some sober and progressive general views. Steinheim stressed the fundamental identity of life under normal and pathological conditions and postulated a scientific treatment of pathology identical in name and essence with that of physiology.

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The author wishes to acknowledge his gratitude to Dr. Arnold Burgen for revising the manuscript.

[1] Pagel, J., Sal. Levy Steinheim als Arzt und Naturforscher. *Janus*, 1903, VIII, 5/6.

Julius Pagel's paper aimed at a full understanding of its fanciful hero in a time which had little sympathy with "romantic" ideas in medicine and science. Perhaps for that reason it was soon forgotten. It was not even mentioned in an extensive bibliographical account of "Romantic Medicine."[2]

This and another[3] *casual* reference illustrated the then hardly credible fact of a consensus between "Romanticism" in medicine and scientific pathology.

In contrast the present writer endeavoured to show that the *ideological superstructure of Virchow's scientific pathology* was, to a large extent, derived from ideas cherished by the exponents of "Romantic Medicine."[4]

If this was true, contacts with Virchow's doctrines must be even more conspicuous in the ideas of the so called "Natur-Historische Schule." This formed the link between "Romantic Medicine" in the first and "Scientific Medicine" in the second half of the XIXth century.

I. The Naturalistic School

("Naturhistorische Schule")

The main exponents of the group were: K. W. Stark (1787-1845), Lucas Schoenlein (1793-1864) and Ferdinand Jahn (1804-1859).

The name "Naturalistic School" was originally coined by Stark and adopted by Schoenlein. It set out to "promote and elucidate Medicine in intimate connexion with the Natural Sciences. It investigates diseases as processes and forms of Life in the same way as other natural objects are dealt with in Science."[5] Natural history in medicine "is but Physiology in a wider sense."[6] This was conceived as a reaction against metaphysical thinking in medicine such as practised by the "Naturphilosophen" in the strict sense and against the multitude of systems and sects which at the time were superseding each other in quick succession. Such were according to Jahn those of the: "Metaphysicians, Idealists, Iatromechanics,

[2] Hirschfeld, E., Romantische Medizin. Zu einer künftigen Geschichte der naturphilosophischen Aera. *Kyklos*, 1930, III, p. 82.—The omission of Jul. Pagel's paper is all the more surprising as Hirschfeld's work belongs to a later period, and professes to deprecate "rationalistic attempts at systematisation" based on the view of straight lines of progress in the history of medicine. (*loc cit.*, p. 3.).

[3] Diepgen, P., *Deutsche Medizin vor 100 Jahren.* Freiburg and Leipzig, 1923, p. 20.

[4] Pagel, Walter, *Virchow und die Grundlagen der Medizin des XIX. Jahrhunderts.* Jena, Fischer, 1931.

[5] Jahn, F., *Sydenham. Ein Beitrag zur wissenschaftlichen Medizin.* Eisenach, 1840, p. VI.

[6] *Ibid.*, p. 17; p. 46.

Iatrochemists, Experimental Physiologists, Natural Philosophers, Mystics, Magnetizers, Exorcisers, Galenists, modern Paracelsian Homunculi, Stahlianists, Humoral-pathologists, Gastricists, Infarct-men, Broussaisists, Contrastimulists, Natural Historians, Physiatricists, Ideal-Pathologists, German-Christian Theosophists, Schoenleinian Epigones, Pseudo-Schoenleinians, Homoeobiotics, Homoeopathists, Isopathists, Homoeopathic Allopathists, Psorists and Scorists, Hydropathists, Electricity-men, Physiologists after Hamberger, Heinrothians, Sachsians, Kieserians, Hegelians, Morisonians, Phrenologists, Iatrostatisticians." [7]

It should be remembered that the introduction of chemistry and microscopy into continental clinical medicine was largely due to the efforts of the Naturalist Schoenlein and his pupils (Loewig, J. F. Simon, Rob. Remak, H. Lebert, L. Traube).[8] This places the Naturalistic School, the immediate successor of speculative Brownianism and "Naturphilosophie" into the right perspective. Even Wunderlich, Schoenlein's adversary, credited him with a nosology based on the study of the positive, material, i. e. anatomical changes and the adoption of physical methods in diagnosis. Schoenlein thus transplanted the spirit of objectivity and definiteness which had prevailed for a long time in England and France to German Medicine. "If the man had still an air of "Naturphilosophie" of the schools of Wuerzburg and Jena about him one was glad to overlook this as immaterial or valued it as ingenious peculiarly German arabesque which adorned the prosaic text." [9]

"Natural History" therefore indicates the method of research on which the new men wished to embark. They professed to "return to those bases and pillars from which medicine took its origin, to lean on the books of Nature—a naturalistic trend of thought." [10] The natural sciences were called upon as guides which should teach how to observe in order to collect experiences which could be applied in practice. To work out a new *method* was thus felt to be most urgent. This prevented dogmatism from developing and a narrow "school" in the strict sense from being formed. "The adversaries did not like it. They wanted doctrines which could be apprehended and torn to pieces, a certain system which they could destroy. In fact, Schoenlein did elaborate systems and propound theories, but he himself never arrived at any conclusion, such as he wished to attain and others supposed he had. The system at which he aimed was to be a

[7] *Ibid.*, p. 2.
[8] Virchow, R., *Schoenlein—obituary*. Berlin, 1865, pp. 79, 80, 90.
[9] *Arch. f. physiol. Heilkunde*, 1843, II, 292.
[10] Virchow, R., *Obituary of Schoenlein*, Berlin, 1865, p. 19.

" natural " one modelled on those arrived at in botany and zoology. But it never came to a standstill; each year saw new changes. For he himself went on observing and could not make up his mind to publish before these observations had assumed steadiness. . . . Only one point remained unchanged in his system: the fundamental division of all diseases into three large groups according to the three principal organic tissues such as animal matter (" Zoogen "), blood (" Vascular system ") and medulla (" nervous system ").[11]

The tendency to form a system is nevertheless the main characteristic of the Naturalistic School. It endeavored to adduce from all branches of natural history empirical evidence which was to bear out a system of pathology conceived by speculation and vision of analogies in nature. " Romantic " Medicine proper had concentrated on the general ideas and elaborated them into the most subtle detail at the expense of independent empirical research. The " Naturalistic School " in spite of its empirical and scientific trends and efforts to prove theories by facts is but an offshoot of " Romantic Medicine." Its chief concern remained the nosological system based on the view of man as part of nature and the world as a whole.

Parallels between this late branch of Romanticism in medicine and Virchow's ideology are indeed striking and even more impressive than those found in the work of the earlier " Naturphilosophen."

The similarity of some of Stark's and Virchow's ideas has been referred to by Diepgen[12] and Walter Pagel.[13] Much more obvious, however, are points of contact with the work of Jahn.

A good account of Jahn and his medical theories has been given by Lehmann in 1936 who noticed in passing and in general terms some parallels with Virchow.[14] But in his short paper this point did not receive the attention which it actually deserves. Moreover Lehmann based his account on Jahn's publications in book form. Much more conclusive evidence can be submitted from one of Jahn's smaller articles published in *Haeser's Archiv* previous to Virchow's appearance in the literary arena. (1843).[15]

[11] *Ibid.*, p. 22 f.

[12] *Loc. cit.*, footnote 3.

[13] *Loc. cit.*, footnote 4, p. 15 and 38.

[14] Lehmann, H., Die Krankheits- und Heilungslehre des meiningischen Hofmedicus Ferdinand Jahn. *Abh. z. Geschichte der Medizin u. d. Naturwiss.* No. XIV. Berlin, 1936, espec. pp. 6, 23, 26.

[15] Die Krankheit als Afterorganisation. *Haeser's Archiv fuer die gesamte Medizin*, 1843, V, 354-400.

II. Ferdinand Jahn, the Physician and Medical Thinker.

Jahn was greatly appreciated as a doctor. Refusal of two calls to universities and many passages from his writings testify to personal modesty and freedom from national, racial and religious prejudice. He had keen interest in and intimate knowledge of the history of medicine which he enriched with original views.[16] Jahn's medical work was not prolific with new discoveries. His voluminous books are redundant [17] and largely devoted to the building up of nosological theories. Yet, the large body of sober clinical observations and scientific facts on which they are

[16] It may be pertinent to mention here a nosological concept which Jahn elaborated: *The morbid predisposition of the Age* as caused by the general trends of Culture and Civilisation. This is quite "modern" in outlook as can be seen from a comparison with the brilliant work on the subject by Henry E. Sigerist, *Civilisation and Disease*. Ithaca, Cornell University Press, 1943, p. 186.

Sigerist says: "There is a certain relation between the prevailing disease of a given period and its general character and style. The Middle Ages was a period of collectivism and the dominating diseases were such collective diseases as leprosy, plague or dancing mania that befell entire groups. In the highly individualistic Renaissance syphilis was in the foreground, a disease that does not attack just anybody, but is acquired through a highly individualistic act. The Baroque period was one of tremendous contrasts and contradictions. The diseases most frequently pictured were deficiency diseases such as hunger typhus and ergotism and luxury diseases such as gout and dropsy."

Jahn introduces the concept of "Welthistorische Krankheitsanlage" in his System of Physiatrics (Vol. I: *Physiology of Disease*. Eisenach, 1835, p. 272-281) as follows:

"Propensity to disease grows in general in direct proportion to the development of higher levels of culture. When these are reached the opportunities for conflicts of the individual with the outside world increase. Hence man is more prone to disease than the animal and still more than the plant. Two main "directions" of vital functions and diseases can be differentiated in man: (a) those connected with the growth, reproduction and development of tissues, i. e. the vegetative system and (b) those associated with the sensory faculties."

"At lower levels of culture epidemic diseases involving the vegetative systems such as the bones (for example in prehistoric animals), the skin (e. g. Leprosy, Plague, Smallpox, Scarlet Fever, Measles, Syphilis, Scurvy, Typhus, Yellow Fever) are prevalent. At later periods diseases and even epidemics causing central nervous symptoms are more conspicuous such as Whooping Cough, Ergotism, St. Vitus' Dance, Tarantism, Epidemic Mania, Epidemic Suicide, Cholera." "It can even be suggested" Jahn continues, "that in the future, with the further development of sensorial functions more epidemics will break out involving them and particularly the higher and highest integrations of nervous life. Then will Lykanthropia, severe forms of St. Vitus' Dance and Animal Magnetism, Religious Mania and Mass Insanity such as observed at the time of the French Revolution, Epidemics of Suicide etc.—all these will be faint shadows and outlines of the epidemics to come;—prospects at which the investigator, ignorant of the higher meaning of Disease should be horrified."

[17] For example large portions of his: *Die Naturheilkraft*, Eisenach, 1831, were reprinted in: *System der Physiatrik*, Eisenach, 1835.

based is impressive, and so is the demonstration of the main tenet of his "Iatreusiology": that most of what is regarded as morbid symptoms are in reality spontaneous ("natural") healing efforts on the part of the body.[18] As a rule his views and arguments lend themselves to the understanding of a present day reader, in contrast to the literary remains of most earlier members of the "Romantic School."

He is one of the first modern describers of "enanthema." Just before, Steinheim had described a "scarlet-fever coryza," and changes in the mouth and pharynx had been observed by Vogel, William, Bateman, Rayer and Hufeland. Jahn discovered in scarlet fever enanthema in *all* mucous membranes and regarded endocardial and vascular changes as its manifestations.[19] Jahn also included the serous membranes which show so often miliary spreads, for example, of tubercles or carcinomatosis. The changes in typhoid fever and cholera were also interpreted by Jahn as "enanthema." By the tendency to cause "enanthema" rather than a rash, he differentiated these from other contagious diseases, such as measles, small pox, scarlet fever where the rash is more conspicuous than the enanthema. Jahn militates against the "romantic" theory which explained enanthema by the "reversion of a polarity" between skin and internal membranes. Jahn said that there was no such "polarity." On the contrary: skin and membranes are connected with each other by "sympathy" rather than antagonism. The enanthema is due to a simple extension from the parts affected first to a mucous membrane and not to an active migration of morbid material into the body.

Jahn gave some masterly clinical descriptions of morbid conditions such a bronchial carcinoma[20] and particularly of the various forms of apoplexy.[21] He opposes the simple identification of "apoplexy" with "cerebral haemorrhage." For if apoplexy is simply due to the destruction of the brain substance by the haemorrhage, why is the symptomatology different in other destructive lesions, e. g., in tumours? Moreover, no haemorrhage may be seen in spite of "apoplexy" and all transitional stages can be found from small paralyses to extensive apoplexy. In Jahn's view, apoplexy is a central nervous disease from the beginning, a neuro-vascular paralysis which causes the haemorrhage by lowering of the vascular tone.

[18] His merits in this respect have been duly recognized in Max Neuburger's classical *History of the Doctrines of the Healing Power of Nature*. Stuttgart, 1926, p. 163 ff.
[19] *Versuch fuer die praktische Heilkunde*. Eisenach, 1835, I, p. 169.
[20] *Loc. cit.*, p. 47.
[21] *Loc. cit.*, p. 70 ff.

If apoplexy is therefore a disease of the nervous system proper and not merely the sequela to haemorrhagic destruction of a part of the brain, the term will apply to extracerebral neuro-vascular disorders as well. Such are Schoenlein's "ganglion-apoplexy." This is the abdominal collapse such as found after traumatic injury to the abdomen, in peritonitis, puerperal fever, incarcerated hernia, abdominal tumours.

In the same way a "heart-apoplexy" can be differentiated, i. e., the state of syncope as observed in heart failure.

And finally one may speak of "mental apoplexy" where no proper paralysis is observed, but only aphasia, paraphasia, agraphia and similar disorders.

Jahn kept aloof from uncritical therapeutic enthusiasm especially in assessing the effects of Homoeopathic treatment. He recognized the efficacy of minute doses (down to 1/60 of a grain) in *certain* remedies such as mercuric chloride and iodine. Most others are without any effect when given in such doses. Their apparently miraculous action only demonstrates the wide range of the healing power of Nature.[22]

Jahn was also a keen morbid anatomist who collected specimens [23] and performed necropsies whenever possible. The statement that morbid anatomy was repugnant to him and that its triumph in the eighteen-fifties accounts for his complete silence in the last years of his life,[24] is unfounded. Jahn described ileus, due to intussusception, invagination and bands, he compared his specimens which "formed interesting exhibits in my small museum" with those examined by Hutchinson,[25] Weber,[26] Humpage,[27] and Wiesenthal.[28] He dealt at length with the anatomical expression of spontaneous healing in tuberculous foci and cavities,[29] with the massive caseation ("obstruction") of lymph glands in scrofulosis, with calcified nodules in the brain (so-called arthritic tuberculomata) and the anatomical appearances of gastric scirrhus.[30] In addition he dissected carefully the vagi in cases of whooping cough in which he believed to have observed a vesicular "enanthema" of the nerves. Finally the description of symptoms and anatomical changes in a case of bronchial carcinoma superimposed on old tuberculosis deserves mention.[31]

All this is associated with a definite deprecation of wanton metaphysical ("hyperphysical") pseudo-explanations. Thus the flaring up of higher

[22] *Loc. cit.*, p. 159.
[23] *Loc. cit.*, p. 213.
[24] Lehmann, *loc. cit.*, p. 15.
[25] *London med. and phys. J.*, 1830, Febr.
[26] *J. hebdomad. de Méd.* V., p. 84.
[27] *London med. and phys. J.*, 1828, June.
[28] *The Med. Recorder*, 1827, April.
[29] *Loc. cit.*, p. 53.
[30] *Loc. cit.*, p. 102.
[31] *Loc. cit.*, p. 103.

cerebral functions in the dying, his divinatory powers, the return of sanity to the insane shortly before death and other natural phenomena had been attributed to the soul already liberating itself from its earthly fetters. In Jahn's view, such ideas are conceived in defiance of any sane attitude to Nature—it is behaving like the ostrich which hides its head from the hunter, in expectation of that transcendental world of the shepherds of which we know neither original nor image, which lacks name, shape and geography, for which neither chemistry nor astronomy are prepared to indicate constituents and continents, a nebulous universe in which a new body is expected to bud from the withered soul. It is only in a symbolical way that invocations of the supernatural light (such as practised by Van Helmont and Jacob Boehme) should be interpreted. They should be translated into physiological terms. A soul conceived as an independent natural-supranatural entity forced upon the body belongs to the realm of chimaera in the same way as does a deity outside and above Nature—one is just as poor and miserable a creation as the other.[83]

In conformity with his comparatively sober attitude is Jahn's admiration for the spirit of cool scientific observation. This he finds embodied in the work of the heroes of *English Medicine*, in particular of Harvey and Sydenham. Jahn's intimate knowledge of the medical classics of the past shows up at its best where he can support his point by quotations from these two authors or demonstrate that an apparently contemporary doctrine was actually conceived or elaborated by them.[83] The most comprehensive account of Sydenhams Theory and Practice of Medicine ever given comes from Jahn's pen.[84] We shall refer to this later in detail.

III. Jahn's Philosophy of Pathology Foreshadowing Virchow's Ideas.

In dealing with Jahn's work I am not actuated by the desire to supplement the knowledge of the man and his merits. It is the aim of the present paper to make clear a few points which I submit for *general* attention in the history and understanding of *modern pathology*:

(1) Modern pathology is connected with and partly based on certain speculative and systematic aspects of Virchow's Cellularpathology, just as much as on its empirical foundations.

[83] *Loc. cit.*, p. 146.

[83] For example: *System der Physiatrik*, 1835, p. 14 ff., 155 ff., 334, 389, 448 and *Die Naturheilkraft*, 1831, p. 191.

[84] See footnote 5.

(2) These aspects can be traced to the speculative medicine which prevailed in the first half of the XIXth century.

(3) The best guide to these sources is the work of Jahn.

Cellularpathology is commonly believed to be the result of empirical observation alone. Virchow is credited with the abolition of speculation and the reintroduction of the spirit of scientific investigation. The review of Jahn's work, however, will go far to show the broad ideological basis of Virchow's empirical research which may be interpreted as the scientific justification of some ideas conceived in the beginning of his century. Jahn's medical philosophy enables us to retrace the background and original meaning of Virchow's general nosological ideas. Virchow presented them in the same books and papers in which his empirical research was published. It does not necessarily follow that they were the *result* of his findings. It is just as possible that they were preconceived and actually directed Virchow in his personal scientific approach and stimulated him to formulate Cellularpathology for which he is remembered to-day. A comparison with Jahn will help to answer this question.

(1) *The Identity of Physiological and Pathological Processes.*

True to philosophical tradition Jahn first raises the question as to the *origin of disease in the world.* A present day scientist would hardly ask it and if asked would probably refuse to answer. Nor did Virchow favour any such general problems, conclusions or even hypotheses which transcend empirical observation. It is owing to this, he said, that scientific research degenerates into "crude empiricism." [35] On the other hand Virchow did discuss epistemological points such as that of the role of purpose in physiology and pathology.[36]

Whatever Virchow's attitude, we cannot omit a discussion of Jahn's ideas as to the origin of disease. They form the premise to all his noso-

[35] Prospectus to *Virchow's Archiv*, Vol. I, 1847; Standpunkte in der wissenschaftlichen Medizin, *ibidem.*

[36] Reform der pathologischen Anschauungen. *Virchow's Archiv*, 1847, I, 207 ff. espec. p. 230. Virchow personally was fond of philosophical and medical-historical studies. This is obvious even from a superficial perusal of his work. (Compare Ackerknecht, E., *Arch. f. Gesch. d. Medizin*, 1932, XXV, p. 147 in opposition to Hirschfeld, E., *Kyklos*, 1929, II, p. 113). In connection with his appreciation of the philosophical attitude of the Naturalistic School, short reference may be made to his Obituary of Schoenlein (Berlin, 1865). Here (p. 5) Virchow mentions the "memorable decrees which made a one year's study of Philosophy the duty of each student (of Wuerzburg University) except those law students who went to the university only in order to secure a subordinate clerical job."

logical expositions, and it is these which we have to compare with those of Virchow.

In Jahn's view disease follows from the relationship between objects and their environment. The position of any object particularly an organic being in the outside world is ambivalent. In order to be and remain what it is it must be well defined and keep its spontaneity and independence. On the other hand it cannot exist all on its own, it has to enter into relationship with other objects and indeed with the rest of Nature. This situation has been designated by the "Naturphilosophen" as "*polarity*."[87] The "poles" indicate two "directions" of life: (a) The egotistic tendencies of the Being towards autonomy; (b) Its receptive leanings to participating in and final submergence into the outside world, i. e. towards self-negation. The former may be called the "egotistic" or "positive," the latter the "cosmic" or "negative" pole. In contrast to his "romantic" predecessors Jahn does not elaborate the polarity-symbolism any further. As it stands in Jahn's work it is reminiscent of certain trends in present day "Theoretical Biology" which differentiate with Uexkuell[88] the "World of Action" and the "World of Perception" which constitute the "Life-Sphere" of the living individual.

The continuous flow in which the world moves involves continuous external change and internal transmutation of natural objects. This may be expressed: (1) in a renovation of their chemical contents with the anatomical form remaining intact (Reil's "Reproduction"), or (2) in a change of shape such as observed in the metamorphosis of insects, the phenomena of growth and maturation ("Progressive Metamorphosis"), or (3) in the generation of new individuals (Metamorphosis per acces-

[87] Particularly by Schelling, Oken, Ritter, Novalis, Kieser, Troxler, Reil.

[88] Uexkuell, J. v., *Theoretische Biologie*. 2nd Edit. Berlin, 1928. For a discussion of "Polarity"-theories in modern biology see: Goldstein, K., *Der Aufbau des Organismus. Einführung in die Biologie unter besonderer Berücksichtigung der Erfahrungen am kranken Menschen*. Haag, Nijhoff, 1934, p. 262 and 202 ff. (particularly p. 206). "Polarity" has been used to designate the relationship between the "whole" of the organism and its parts (Oldekopp), a contrast which can be followed up in Nature at large. It is due to the elementary fact that (a) "Form" is a unity which cannot be arrived at by summation of the parts and that (b) parts represent a multitude which cannot be deduced from the unity of the "whole" (see Goldstein's criticism of this theory, *loc. cit.*, p. 262).— In Psychology consciousness implies a separation of the Ego from the outside world, whereas the subconscious represents a "Being in the World." The former corresponds to the maintenance of the Ego which forms its own sphere of action ("Ausleben") and is responsible for its physical existence, in other words to the "positive" pole, the latter to passive sensation of the outside world ("Erleben"), the "negative" pole of the "Natural-Philosophers" and "Natural-Historians." See also Goldstein, *loc. cit.*, p. 58 on the significance of exogenous and endogenous stimuli for central nervous function.

sionem), and finally (4) in the cessation of the existence of the former individual and its passing into other forms of existence.

Although there is no such thing as complete annihilation,[39] the individual struggles against death, i. e. its transformation to other forms of existence. Owing to this struggle a stage intermediate between life and death is bound to appear. This is disease. Disease is therefore the precursor of death. To be sick is tantamount to dying and to be healthy due to a continuous process of resuscitation.[40]

Death occurs in all living creatures of necessity. It is *always* and *of necessity* preceded by disease—even the so called "Natural Death" in old people which is actually due to general atrophy. Death as well as disease are therefore "natural phenomena" like any other phenomenon in the world, they are "Fractions of All-Life." Death and disease are functions as any other vital phenomena. They are subject to the same "directions of life," namely the tendency towards individualisation and separation on the one hand and to submergence of individuality into the universe on the other. The cause of death and disease in general is the exaggeration of either of these directions of vital phenomena.

It follows that physiological and pathological processes are identical in essence. Disease is life, though modified.[41]

This is one of the fundamental tenets of Virchow's pathology. Disease is life under modified conditions. There are only quantitative, locative and time differences between "normal" and "pathological." There is no such thing as "heterology" in pathological formations. Mucoid tissue found in the brain is genuine human tissue, but at the wrong place. A myxoid tumour at the umbilicus of an adult shows formation of tissue at the wrong time. A chorionic epithelioma exhibits an excess of tissue in quantity.[42] It was one of Virchow's elementary convictions "that each pathological formation has a physiological pattern and that no pathological form develops whose elements cannot be referred to a pattern existing in animal life."[43] Virchow personally recognized the "essential merit" of the "Naturphilosophen" in having attempted to refer the apparently diverse forms of neoplasms to physiological paradigmata.[44] If the cell,

[39] This is the Leibnitian concept of: "Nulla Mors in Natura" in which it is quoted by Jahn. We shall see later how much of Jahn's biological philosophy forms a link with Van Helmont, Leibniz and Virchow.

[40] This has been formulated by "Naturphilosophen" such as Malfatti and Kieser, who said: "Sickness is dying during life, recuperation is resuscitation of life in life."

[41] Jahn, F., *System der Physiatrik*, Eisenach, 1835, p. 13.

[42] *Cellular Pathology*, 4th Edit. Berlin, 1871, p. 84-89.

[43] *Ibid.*, p. 84.

[44] *Ibid.*, p. 85.

the elementary unit of the body was the only "Ens," seat and centre of disease, only products or transformations of this cell and nothing foreign, "heterologous" could be expected to develop and to matter in disease. The demonstration of the cellular nature and origin of pathological phenomena would therefore prove the theory of the identity of the physiological and the pathological. But would not also the conviction of its correctness on general grounds direct the investigator to the scientific approach by means of which it can be proved empirically?

In this connection it is well to remember that the identity of physiological and pathological phenomena was held long before Virchow. We may refer with Jahn to the fundamental principles of Greek medicine which was seeking for the "natural" as against the supranatural explanation of morbid phenomena.[45] It was expressed much more clearly and definitely by the great adversary of Greek medicine J. B. Van Helmont (1579-1644).[46]

What is more important, however, this idea has always been also the result of a *Philosophy*. In Jahn's work this philosophy is easily recognisable. It is, no doubt, preformed and expressed in the work of his "romantic" predecessors, but there it hardly lends itself to the understanding of a modern reader. Moreover, Jahn is not satisfied with the mere deduction and formulation of the general principle. Jahn is particularly concerned with the submission of empirical support for this thesis, as his whole work revolves around the demonstration of the "Healing Power of Nature." He endeavours to show that *morbid* phenomena are to a large extent the expression of *physiological* efforts at regulation enabling the body to overcome disease and to restore the harmony of normal life. This emerges for example in the formation of granulation tissue in wound healing. This follows the pattern of ***nutrition***

[45] "Γίγνεται δὲ κατὰ φύσιν ἕκαστα." See Hippocrates π. ἱερῆς νούσου, 1 ff. and Galen, *De Hippocr. et Platonis placitis*, VI, 1. Edit. Kuehn, Vol. V, p. 507.

[46] "Actus itaque, qui est de essentia, existentia et subsistentia, prout etiam de propagatione contagionisve fertilitate morborum, pendet omnino in vita, ex vita, per vitam, intra quam etiam clauditur." This is the passage quoted by Jahn. The concept was expressed even more definitely at several other places in the *Ortus Medicinae*, for example: "Quidquid in sanis edit actiones sanas, id ipsum in morbis edit actiones vitiatas." De Febrib. I, 27. In Ignot. hospes morb. 40 it says: Disease and normal life cannot exist together, but disease is a form of life, namely of vitiated and degenerated life. It takes part in life which it forms according to its own schedule. And *ibid.*, 82: Nutriment offered, but not accepted by the Archeus, may turn acid and, acting as a trigger, occasion disease. This, however, is a deep seated affection of the very sources of life, the "Initia Vitalia"—places with power and action far above that of such—acid—substances which are subject to excretion.

and tissue apposition under physiological conditions. It begins with a conversion of red blood cells into colourless " granules of animal matter." Wound healing can thus be interpreted as a process of tissue *nutrition*. The flow of blood corpuscles to the injured area is increased. The pathological process of wound healing thus involves an accentuation of vital functions (" Steigerung ") with subsequent concentration and accumulation of nutritive material. In the same way fever accompanying wound healing is an exaggeration of the slight increase in temperature in physiological digestion (" Verdauungsfieberchen "). The other physiological pattern to which wound healing bears resemblance is *Generation*. This can be interpreted as a modified process of nutrition. Paracelsus said that we are " reborn by our daily bread." [47] Harvey held that generation and apposition of tissue are processes of nutrition just as nutrition is a sort of generation.[48] In wound healing a sequence of formations leading from a fluid to a solid state is observed as in generation. In fluid plasma clusters of granules are formed which become free, motile and take part in the development of small vascular systems—the wound granulations. Moreover, there is physiological wound healing. It occurs periodically for example in the regeneration of antlers, in the Graafian follicle after conception, in the umbilical wound of the newborn.

There are physiological paradigmata of stoppage of haemorrhages, e. g. in menstruation, the involution of milk teeth and branchial arteries. In these as under pathological conditions stasis of the bleeding is largely due, not to posthaemorrhagic weakening of the blood flow, but to increased activity of the vascular systems in the neighborhood whereby the traffic is diverted from the injured area into them. The blood stream first " ignores " as it were the wounded area, and it is only later on, in an empty vessel that a thrombus forms. Hence empty vascular stumps are

[47] *Opus Paramirum*, I. Cap. 7. Ed. Strunz, Jena, 1904, p. 122 ff.

[48] Harvey, W., *On Generation*, Exerc. X (transl. R. Willis, London, 1847, p. 202). " Growth implies and includes the idea of nutrition." The egg is engendered and made to increase by a certain natural principle peculiar to itself. This principle causes it to be nourished and to grow, " just as there is a certain faculty in every particle of the body which secures its nutrition and growth." Particularly *ibid.*, Exerc. LIV, *loc cit.*, p. 399: generation and growth do not proceed without nutrition, nor nutrition or increase without generation; to nourish being in other terms to substitute for a certain quantity of matter lost as much matter of the same quality, flesh or nerve. . . . But what is this but to make or engender flesh or nerve? In like manner growth cannot go on without generation, for all natural bodies are increased by the accession of new particles similar to those of which they formerly consisted, and this, taking place according to their dimensions, they are distinguished as regards their parts and are organised at the same time that they grow.

observed not infrequently in pathological cavities. In addition to the diversion of blood by increased activity of the vascular systems adjacent to the wound there is the passive factor of the absence of its functional attraction into the injured area in which the tissue is subject to degeneration and death.

Regeneration and transplantation afford the best opportunity of studying the physiological pattern of pathological processes in the experimental animal.

Another series of phenomena which physiological and pathological processes have in common is Periodicity. Burdach [49] had shown that the function of the muscle is a biphasic action of remission and exacerbation, that the muscle is never at complete rest, but exhibits an internal oscillation ("innere Bebung") without any obvious alteration of its condition. The same applies to *all* vital functions: respiration, circulation, peristalsis, nervous activity, excretion and reception of nutritive material, the function of excretory ducts which occurs "in jerks with small more or less perceptible remissions." There are also daily, monthly, seasonal, yearly variations and the gradual reaching of a climax which can be traced in normal as well as pathological processes. Thus the pulse is the physiological pattern of abnormal pulsation. *All*—normal—functions associated with circulation, digestion, absorption, secretion, internal nutrition (i. e. tissue apposition) reach a climax in the evening and towards midnight. Hence the rise of temperature at these times in disease. *All* processes of resolution, evacuation and demarcation increase after midnight. Hence the return to normal and the processes of lysis, the spontaneous opening of abscesses etc. in the early hours of the morning.

(2) *The Local Origin of Disease. The Cell as the Ultimate "Seat of Disease."*

It is from his philosophy that Jahn draws a second conclusion which is of importance in the light of Virchow's doctrines. If disease is an expression of the struggle of the individual against annihilation, it cannot involve the whole body at once which would make such struggle impossible as it is incompatible with life. Hence disease must of necessity begin as a *local* affair. Another philosophical reason for this is the fact

[49] Burdach, K. F., *Handbuch der Physiologie*, Leipzig, 1832-40, Vol. 4 and 5. Similarly the "nervous system" is never "at rest" and it is not so that its action is elicited by particular stimuli. These cause only an alteration of a permanent state of excitation. (Goldstein, K., Der Aufbau des Organismus, 1934, *loc. cit.*, p. 69).

of *organisation*. The mere existence of organs postulates that disease should start in one of them. For each organ, nay each fibre has its own peculiar life ("Vita propria") and represents a "relative totality." Owing to its *local* aggression disease creates a "double life" in the body, a "break of life in itself" since some of the functions retain their normal, whereas others obtain a pathological direction.

In this two of Virchow's main tenets are clearly foreshadowed:

(1) The local origin of disease in one of the organs. Previously I have endeavoured to show [50] that it was not the concept of cellular physiology or pathology which gave young Virchow's research its fundamental direction, but the tendency to disease-location and the opposition to vague humoralism and constitutionalism. Virchow recognized in his very early life that local formative processes, not dyscrasia and constitution are decisive in the pathology of such widespread diseases as tuberculosis and cancer.[51] It is the formation of a local blastema and not the emigration of cells through the vascular wall which accounts for cellular proliferation or pus.[52]

(2) The organs and ultimate units of organs are the centres of life and function in health and disease. This is obviously the cellular concept. It led Virchow to regard the animal as a sum of vital units, each of which bears the full character of life. In his opinion the character and unity of life cannot be found in a certain single point of higher organisation such as the brain in man, but only in the well defined and constant equipment possessed by each single element. Hence the composition of a larger body always exhibits a sort of social institution, a social organism in which a multitude of individual beings depend upon each other so, however, that each element has its own activity and lets its proper function irradiate from itself although it receives the stimulus for activity from other parts.[53] An outward criterion of the far reaching autonomy of the members of the cell state is the unequal development and fate of the tissues. They do not all develop at the same time nor do they die simulta-

[50] Pagel, W., *Virchow und die Grundlagen der Medizin des XIX. Jahrhunderts.* Jena, 1930, p. 17, 23, 25.

[51] Virchow, R., *Verhandlungen der Würzburger med.-phys. Gesellschaft*, 1850, I, 81 and 134.

[52] Virchow, R., Reform pathologischer und therapeutischer Anschauungen. *Virch. Archiv*, 1847, I, 207. On the anticipation of Cohnheim's experiment (finally establishing the emigration of leucocytes from the vessels) by Addison (1843), and Zimmermann (1852), see: Schlumberger, H. G., Origins of the cell concept in Pathology. *Arch. of Path.*, 1944, XXXVII, 396; part. p. 404.

[53] *Cellular Pathology*, 4th Edit., 1871, p. 17.

neously. The designations which we choose for the developmental stages of the organism as a whole do not by any means apply to the individual parts and tissues. There are juvenile tissues in old age and senescent parts in the fetus. Even the bulb of the gray hair generates ever new elements and until death ever young blood corpuscles enter the circulation. Many elements die a natural death in fetal life: Meckel's cartilage, Wolff's body, etc.[54]

Virchow regards the ultimate units of life, the cells, as centres of "nutrition." He follows here John Goodsir, who as early as in 1845 described the cell as a nutritive centre in that it forms the matrix for the new and young cells. These appear first in the mother cell, from which they "pass out in certain directions and under various forms according to the tissue or organ of which their parent is a part." [55]

It was "nutrition" which Jahn regarded as the fundamental function of tissues and vital units and it was by nutritive function that nature accomplished tissue growth, apposition and spontaneous healing.

When elaborating the "seat" of the physiological and pathological phenomena in the ultimate units of the organs and tissues Jahn speaks of the autonomous life of the "Fibres," true to Hallerian tradition. In addition he mentions (a) cells as "tissue-globules" such as described by the immediate forerunners of cellular histology, for example Dutrochet,[55a] Milne Edwards, Oken and others.[56] Jahn also evolves (b) the concept

[54] *Ibid.*, p. 73.

[55] Goodsir, J. and H. D. S., *Anatomical and Pathological observations*, Edinburgh, 1845. Reprinted in Goodsir, J., *Anatomical Memoirs*, ed. W. Turner, Edinb., 1868.

[55a] As A. R. Rich has shown, Dutrochet not only "foreshadowed" or "anticipated" Cell Theory, but established and formulated it 15 years before the publication of Schwann's monograph. It was Dutrochet who described in 1824 the universal cellular structure of living animal and plant tissues, maintained that growth consists in the formation and expansion of new cells, observed "Cellules Vagabondes" 50 years before Cohnheim, discovered Osmosis and its importance in cellular metabolism and formulated a mechanistic concept of life identical with that of Schwann. Rich's brilliant paper (The Place of R. J. H. Dutrochet in the Development of the Cell Theory, *Bull. J. Hopkins Hosp.*, 1926, XXXIX, 330) is of the utmost significance in the history of biological theory and of ideas at large. It not only places Dutrochet in the high rank to which he belongs but also the assets of Schwann's work in the right perspective. Schwann was original in the discovery of organisms causing fermentation and the exclusion of spontaneous generation—which is commonly attributed to Pasteur.

[56] Dutrochet, *Recherches anatomiques et physiologiques sur la structure intime des animaux et des végétaux et sur leur mobilité*. Paris, 1824, p. 201.—Milne-Edwards, H., Recherches microscopiques sur la structure intime des tissues organiques des animaux. *Ann. des Sci. Natur.*, 1826, IX, 362.—Oken, L., *Elements of Physio-Philosophy*. Transl. by A. Tulk. London (Ray Soc.), 1847, p. 189 and p. XI (refers to Oken's book: *Die Zeugung*, Frankfurt, 1805, where he advanced the doctrine that all organic beings consist of cells or vesicles).

of the " cell," i. e. the unit of primitive undifferentiated myxoid tissue, as the ultimate seat of disease. This " cell " represents a primitive vesicle, a minute " hydatid " and is, no doubt, meant in a similar sense as the " modern " cell. It is, however, a pre-Schleiden-Schwann concept. We shall refer to it later on (see footnote 94). In the earlier times of cellular histology, but before the appearance of Virchow as a scientific author in 1843, Jahn replaced the vague " globules " and minute " hydatids " by the cells proper (see footnote 119). Then he quite clearly declares them to be the ultimate units of normal and pathological life and thereby anticipates cellular pathology in its theoretical foundations.

The two concepts of disease-localisation and the cellular theory of disease seem to emerge in Virchow's work as the product of *empirical* research. In reality they are part and parcel of a *philosophy.*

Again—this philosophy can be retraced to J. B. Van Helmont. In his opinion: " Disease obsesses a part of life." [57] Not unlike Virchow, Van Helmont was actuated by opposition to Humoralism. For this did not recognise particular seats of diseases. It regarded the whole individual, the disturbance of its humoral balance as the essence of disease (H. E. Sigerist).[58] To Van Helmont it was a local aggression of the pathogenic agents which initiated diseases and the local affection of the organs which sustained them. He thus refuted the " Folly of Catarrh ": that disease originates in a flow of mucus from *one* source, i. e. the head, to a variety of organs subjected to it. No, " Diseases develop through the peculiar morbid predisposition innate to each part of the body, its own disturbance and caused by local affection." [59]

(3) *Jahn's Speculative Pathology as a Link with Van Helmont, Glisson, Leibniz and Virchow.—The " Monads " and the " Cell-State."*

Already, in Van Helmont's nosology the tendency to locate diseases in

[57] " Obsidet Morbus Partem Vitae." Ignot. hosp. morb. 8. The actual passage runs as follows: " Non applicatur autem promiscue hostis morbus ad vitam, nisi partem vitae obsederit, adeoque in ipsamet vita totaliter vel partialiter sederit. Quo facto pars ipsa vitae obsessa, vel devicta, recedit a vitali aura et degener facta, fit hostilis, vitae adhuc residuae, sive adhuc in sui integritate constitutae." The enemy " disease " does not affect life, unless it has taken possession of a part of life and hence settled down in the whole or a part of the life (-force). The part of life overcome degenerates and proves hostile against the rest of life.

[58] Sigerist, H. E., *Antike Heilkunde.* Muenchen, Heimeran 1927, and " On Hippocrates." *Bullet. Inst. Hist. Med.*, II, 1934, 190 ff.

[59] " Folly of Catarrh " 3. See Pagel, W., J. B. Van Helmont, Berlin, 1930, p. 44 and 145.

certain organs and tissues was associated with an emphasis laid on the individual life of the organs and indeed their smallest units. These are, to Van Helmont, not material particles such as fibres or cells alone, but the dynamical governors of form and function inherent to and together with the particles of matter thus "organised" by them. These are Van Helmont's *Archei*. They have been often confounded with psychoid entities such as Stahl's Anima which acts like a dictator on inert matter which it constantly preserves from putrefaction. In contrast Van Helmont's Archei are inseparable from and unthinkable without the "organised" material carrier, i. e. the natural object. They do not act *on* it, but *in* it. It is thus that they become origin and centres of diseases. They combine with the outside pathogenic agent such as a contagium, poison inhaled in mines, a morbid imagination transmitted by the bite of a mad dog etc.

Francis Glisson (1597-1677) modifying the Archei, demonstrated the "Energetic Nature of Substance" (1672). Any object in nature, organic or inorganic, is endowed with an immanent life-force. It is matter itself which contains the root of life, i. e. the fundamental principle of subsistence and function (operatio) which is responsible for perception, appetition and motion. It acts from inside the natural object ("ab intus"). Glisson had based this on minute observations of organic fibres, their irritability, contractility, tonus. It was he who discovered the rhythmic entry of bile into the duodenum and recognised that this was due to the vital action of a special sphincter.

Leibniz (1646-1716) referred to the innumerable living units which the microscope had revealed in his days in a drop of water. He thus conceived the world and also the individual object in nature as an aggregate of innumerable small units, each endowed with its own life-force.

All these much earlier and philosophical theories are no doubt in theoretical outline forerunners of Virchow's concept of the body as a "Cell-State." *Jahn* who subscribed to views similar to those of Van Helmont, Glisson and Leibniz can therefore be seen as a *link between these and Virchow*.

This is even more obvious when we examine their opinions as to the relationship between the body as a whole and its parts.

The ancient Greek concept that nothing really dies or is born in nature, is taken up by Jahn in the form in which it was expressed by Leibniz, i. e. as a biological theory in the modern sense.[60]

[60] "Nulla Mors in Natura"—see Leibniz, *Système nouveau de la Nature*, 1695; *Opp. philos.*, Erdmann, p. 126. Sur l'esprit universel, 1702, *ibid.*, p. 180. Principes de la nature et de la grace, 1714, *ibid.*, p. 715. Lettre à Bourguet, 1714, *ibid.*, p. 719.

Leibniz believed that the Monad, i. e. the ultimate unit of existence, cannot perish. The Monad is a created and therefore real (not only phenomenal) "punctual" (i. e. non-physical) centre of force. It is endowed with a schedule, i. e. a functional "direction" of its own, in other words it lives. It follows that—unlike the atom—it is different in *quality* from all other monads. The monads also embrace a material principle which enables them to co-exist. In order to appear as individual entities they must be separable from each other and prevented from becoming confluent as they certainly would were they purely spiritual.[60a] The material aspect of the monad may be "Primary Matter" endowed with the purely passive power of resistance or "Secondary Matter," the organised "Massa corporea" of the natural object. "Dead" bodies met with in nature are in reality aggregates of innumerable monads inherent in particles of "secondary matter." The object *appears* to us as a unit. It is, however, only as much a unit as a pond full of fish or a flock of sheep. In other words it is a unit *qua* phenomenon, not *qua* reality, or as Leibniz says an "Unum per Accidens." It is therefore no "substance" as is the Monad, but a multitude of such "substances." The living organic being, however, represents a real "substance," as in addition to the multitude of the monads composing the organic body it contains a "Central Monad." Hence it is an "Unum per Se." Its parts are integrated to an "organic" whole by the offices of the central monad which acts as a "Vinculum Substantiale." [61] The central monad carries out what is usually attributed to the Soul. It coordinates the particular functions of each of the organs and their innumerable parts and particles, i. e. of their monads. Death is but a new arrangement of the monads including the central monad. It is their combination which perishes, not any of the monads themselves. Life is *de*velopment, death *in*volution to lower and mostly invisible forms.[62]

[60a] In this connection Giordano Bruno should be mentioned who emphasised the significance of the material part in the semen. (For example in *De Monade, Numero et Figura. Opera Latina.* Rec. F. Fiorentino. Vol. 1. part 2; Neapoli, 1884, p. 396 ff. The "Materia Proxima" for man, plant and metal is the "Semen," the "Materia Prima" that matter which all semina have in common. Stones and ores are subject to generation although this is not as obvious as in the organic world. Their "spiritus" governing generation is a "materia occulta." It is a "spiritus terreus," emitted in the viscera of the earth which predominates in copper and iron, whereas the spirit in tin and lead is aqueous, and like air in ores and silver, and ethereal in gold alone. These four "spirits" are only derivatives of the one common to all bodies which can commute a small quantity of silver or gold into a large mass of these metals.)

[61] Leibniz, Lettre à M. Remond de Montmort sur le livre du Père Tertre contre le Père Malebranche, 1715. *Opp. philos.* Erdman, *loc. cit.*, p. 735. Lettre à des Bosses, 1712-1713, *ibid.*, p. 685.

[62] Leibniz, Lettre à Bourguet. Erdman, *loc. cit.*, p. 718. See footnote 60.

Monads may enter existing colonies of monads—but whatever happens, life and death, combination and separation take place according to pre-established harmony. There is complete determinism.

It is the independent position, in Leibniz's philosophy, of the individual monads rather than the introduction of a central regulation which calls for a comparison with Virchow's ideology. For Virchow, though recognising essential centres of organisation, rejects the idea of the " Spiritus rector." He says: " There is no reason to fear that our many vital units will let us lose the unity of the living organism. It is true that we are unable to demonstrate it in the sense of Neuro-Pathology. The Spiritus rector is missing, it is a free state of single beings equal in right, though not equal in endowment, a state which keeps together, because the individuals depend upon each other and there are certain centres of organisation the integrity of which ensures the necessary nutritive material reaching the individual parts. . . .

One may therefore say with Mr. Spiess that the cells must be offered nutritive material, but one ought to add that it is for them to decide whether they want to take it." [63a]

Leibniz has most of these positions in common with Van Helmont. With some of these parallels I have dealt elsewhere.[63] It may suffice to mention a few points:

(1) Like the monads Van Helmont's Archei do not normally perish, but may enter new colonies of Archei after dissolution of the aggregate to which they originally belonged, or may revert to invisible " Seeds." (2) The living organism, is not a mere aggregate of Archei, since it is represented by an Archeus of its own, the Archeus Influus, obviously the counterpart of Leibniz' Central Monad. (3) Just as Leibniz, Van Helmont subscribed to Determinism. Hence he rejected the doctrines based on material interaction between the organs, and between Body and " Soul " which were supposed to be due to mobilisation of vapours and humours. He emphasised the " Consensus " as against the " Commercium," i. e. mutual physical influences of living entities or natural objects at large.[64] In Van Helmont's terminology the innate " magnetic " forces of Sympathy take the place of what Leibniz later on elaborated on general

[63a] Virchow, R., Cellular-Pathologie, *Archiv. f. pathol. Anat.*, 1855, VIII, 25.

[63] Pagel, W. The Religious and Scientific Aspects of Van Helmont's Science and Medicine. *Suppl. 2. Bullet. Hist. Med.*, Baltimore, 1944; id., *Nature*, 1944, CLIII, 675.

[64] Leibniz: " Les âmes s'accordent avec les corps et entre elles en vertu de l'Harmonie préétablie et nullement par une influence physique mutuelle." Lettre à de Montmort. Erdmann, *loc. cit.*, p. 736. Leibniz, Epist. XX ad des Bosses, 1712. Erdmann, *loc. cit.*, p. 682-683.

philosophical lines as "Pre-established Harmony." Van Helmont's "magnetic forces" are represented, in the living organism, by the "Actio Regiminis" which controls the carrying out of life functions according to innate schedule by means of central regulation (our "vegetative nervous system").

(4) To Van Helmont all action in nature is due to the acting entity "imagining" its own "form," [65] to an awareness, however dim of its schedule of life. To this correspond the "Small Perceptions" which, in Leibniz' view, account for the gradual changes in the monads.

(5) Leibniz differentiated "Life" as represented by the "Monad" from "Soul" as perceptible in the animal and "Mind" as appearing in human reason. "Archeus," "Anima Sensitiva" and "Mens" are the corresponding links which, in Van Helmont's world lead from the simple organisation of matter to the highest qualities of a conscious representation of the outside world.

Jahn misinterpreted Van Helmont as an exponent of "Animism," as an out and out idealist who neglected the exigencies of matter. At the very outset of the "System of Physiatrics" [66] he declared that dynamic agents and matter, processes and organs, soul and body are found everywhere in nature and closely bound together, that everything is alive, that there is no activity without matter and no matter without activity. This is precisely Van Helmont's, Glisson's and Leibniz' conviction. It is the "Forces," "Dynameis," the "Energy" intrinsic in organised matter to which a central position was accorded in the systems of these thinkers. Only unorganised and undisposed matter was regarded as inert-water by Van Helmont, whereas neither Glisson nor Leibniz believed that such a thing as unorganised matter exists at all. Neither of them therefore neglected matter and its exigencies in Nature quite unlike Stahl who deliberately did. Hence Jahn quite wrongly dismissed their "Dynamism" as a branch of "Idealism" to which he was just as unwilling to subscribe as to "Materialism," "Spiritualism" or "Dualism." He quotes in his own support the words of Paracelsus: "There is nothing corporeal which has not a spirit hidden in itself. And not only has Life what creeps and moves such as man, animals, worms, the birds in heaven and the fishes in water,

[65] On the significance of "Imagination" as an intermediary between thinking and being in the philosophy and mysticism of the Renaissance and XIXth Century Romanticism see Koyré, A. *La Philosophie de J. Boehme.* Paris, 1929, p. 205 ff. (Paracelsus, Boehme); and "Paracelse." *Revue d'Histoire et de Philos. religieuses.* 1933, XIII, 46 and 145 ff.

[66] *Loc. cit.*, p. 7.

but also all corporeal and essential things." [67] Obviously this is in substantial conformity with our XVIIth century thinkers. In their opinion "Life" as the expression of a created intrinsic schedule of function covers organic as well as inorganic objects, i. e. the world of the monads. Yet, as we have shown, Leibniz had clearly recognized the difference of organic and inorganic things. By virtue of the central monad the former are wholes in reality and not like the latter only in appearance. Stahl emphasised the difference between living and non-living, but, in contrast to Leibniz failed to see the significance of organisation.

Jahn rightly felt the inferiority of Stahl's doctrines in medicine, especially in the definition of disease. This, in Van Helmont's system is due to a creative "seed" which gets hold of a part of the material frame of the body and "organises" it according to its own schedule of life. Disease thus becomes a positive *Ens*. In Stahl's theory just as in most other theories it is a *term*, i. e. the expression in human language, for a deficiency and deprivation. In Stahl's case it was his nebulous "Soul" and its power to preserve the body from decay, which was failing and disturbances of circulation in which its failure became most perceptible. Jahn says that up to his own times Van Helmont's was the last consequent nosological system. After Van Helmont nosology fell into abeyance and decay from which it was saved by the efforts of the "Naturphilosophen," i. e. Schelling and his pupils.[68]

It may be pertinent to mention that in spite of his shortcomings Stahl had some palpable influence on the development of certain pathological systems of the XVIIIth and early XIXth century. He certainly did not initiate, however, "Vitalism" proper as propounded by the School of Montpellier (Bordeu, Barthez, Dumas).[69] This was conceived in opposition to Stahl's "Soul," which embraced vital impulses as well as intellectual and emotional faculties. The "Vitalists" realized the separate positions of physiological as against psychic functions. But Stahl's influence is perceptible in certain British classics such as the works of Cullen, John Hunter, Charles Bell. A glance at Bell's "Dissertation on Life" by which he supplemented his edition of Paley's "Natural Theology" [70] will make this clear.

[67] De vita rerum naturalium. Lib. IV of *De Natura Rerum*, ed. Aschner, Jena, 1930, Vol. III, p. 239. Ed. Sudhoff, Vol. VI, p. 276.

[68] *System der Physiatrik*. 1835, p. 29.

[69] See for example Bordeu, *Oeuvres, ed. Richerand*. Paris, 1818, Vol. I, p. 224.

[70] Paley's *Natural Theology* with illustrative notes by Henry Lord Brougham and Sir Charles Bell, to which are added Supplementary Dissertations by Sir Charles Bell. London, 1836, Vol. II, p. 399 ("On Life").

Bell gives expression to the utter failure of the "exact" sciences to advance the "Science of Life." Their methods are so inadequate for the latter that they lead ingenious minds to be satisfied with false analogies taken from the world of non-living objects accessible to the study by the mathematician, astronomer or chemist. The result is that they "cease from inquiry and leave science stationary. The mathematical and mechanical physicians long retarded the true knowledge of Physiology." Only Haller and Hunter promoted, nay, founded it; which was therefore at the time of his writing (1836) a recent science. Hunter started with the discovery that a "living" chick embryo will prevent the contents of the egg from putrefaction, the organised as well as the unorganised such as white and yolk. In other words the influence of life was to counteract the chemical affinities and to prevent the matter from falling into a putrescent state. This is obviously an empirical proof of Stahl's main tenet that life is maintained by a constant preservation of matter from putrefaction. Hunter went farther. He found that life was also expressed by the ability of the egg with the living chick embryo to withstand freezing. He demonstrated that blood clotting was a vital process different from similar phenomena in inorganic objects such as jellies. A live body is essentially different from a machine in that it has the power of regeneration. Hunter's view of the body as a whole is of particular interest to us: "The whole body is a collection of parts, possessing different endowments of life, exhibiting, by different phenomena, the presence of that life; and these different endowments have a bearing to each other, or a systematic arrangement by which the communication is established between the mind and the external and material world." [71] This is indeed reminiscent of Virchow's view which sees the body as a state composed of units, each of which is endowed with its own life. Yet, in Stahl, Hunter, Cullen the functional view prevails, there is the emphasis laid on the regulating power of the central nervous system, the excitability, the transmission of stimuli from muscle to muscle, to heart, lungs and brain; it is more the chief organs than the uniform "monotonous" ultimate units which are considered.

One of the main phenomena of life is preservation from putrefaction in Stahl's sense which is fully adopted by Hunter as well as Charles Bell. A definition of life is thus to be based on the differentiation of "living matter which is subject to a controlling influence which resists the chemical agents, and produces a series of revolutions, in an order and at

[71] Bell, *loc. cit.*, p. 405.

periods prescribed; the other, dead matter is subject to lapse and change under chemical agency and the common laws of matter." (Bell *loc. cit.*).[72] As we have seen this differentiation goes back to Stahl. It could be easily retraced to Aristotle, but there is hardly any doubt that not he but Stahl is the immediate source from which the early XIXth century physiologists derived inspiration.

Finally life, according to Bell, can be further illustrated by a comparison with the atomic structure of inanimate matter. In it the particles are permanently arranged and exhibit their phenomena until the arranging influence is removed. Then the matter is chemically dissolved and may form new combinations. Life, however, prescribes the law for the material which remains quite *passive*,[73] it arranges the particles, it gives them the order and organisation of the animal body and it " whirls them in a series of revolutions," the order, succession and duration of which does not depend upon the material of the frame. This is the same in *all* animals. But it does not depend upon the influence which we term " life " and which is *superadded* to the material.

Here again the influence of Stahl's ideas emerges. It is not the impulse intrinsic to matter and inseparable from it, but something coming from outside and subjecting matter to its dictatorship which represents life. The material organisation of the body cannot therefore be in any way of primary interest. Thus, the animistic concept in the strict sense does not lead up to Virchow's point of view. For it neglects the structural organisation. This serves as a primitive illustration of design in nature and thereby satisfies the yearnings of a religious mind. It would be interesting to examine how far the exponents of animism were actuated by religious reverence in separating the realm of life from that of inorganic nature. Such motives were certainly operative in Stahl, and certainly not in the Vitalists of the School of Montpellier. Van Helmont no doubt derived his concept of life from his religious belief which is deeply bound up with his scientific work, but led him to theories fundamentally different from those of Stahl. It is his ideas which foreshadow much more than those of Stahl and his followers, the concepts of Virchow, and we have endeavored to show the line of development which leads from him to Glisson, to Leibniz, and to Jahn. Van Helmont had an enormous influence on his time. This emerged particularly in the second half of his own century. His life work, the posthumously edited *Ortus Medicinae*

[72] *Ibid.*, p. 407.
[73] *Ibid.*, p. 409.

(1648) was soon translated into English,[74] French [75] and German.[76] The Latin text went through many editions of which the last appeared in 1707.[77] Bordeu [78] aptly formulates the influence, which Van Helmont had, as follows: "He lived, nay reigned in the XVIIth century. He established a new medicine. Closeted in his room he gave Europe its laws. Unknown to his next-door neighbours he made tremble the old professors of all faculties who abused him, biting the reins which he had made for them. He inspired an infinite number who cultivated the new field which he had tilled."

The discovery of the acid gastric juice was soon incorporated in the current textbooks of physiology and medicine, although these retained for a long time humoralistic doctrines.[79] The great classics of medicine and chemistry such as the works of Glisson, Willis, Boyle, Boerhaave, Haller discuss Van Helmont's views and define their own position towards them.[80] Some writers on medicine hailed his opposition to Galenism in a way comparable to the welcome given to Protestantism or a political revolution.[81]

(4) *The Ontological Concept of Disease.*

Jahn's work thus opens up the vista to some of the philosophical and

[74] *Oriatrike or Physick refined.* Transl. by John Chandler. London, 1662.

[75] *Oeuvres,* Lyon, 1670, by Jean le Conte.

[76] *Auffgang der Artzney-Kunst.* Sultzbach, 1683 by Knorr von Rosenroth.

[77] Ed. M. B. Valentini. See the critical bibliographical notes by J. R. Partington, J. B. Van Helmont. Annals of Science, 1936, I, 359.

[78] Oeuvres ed. Richerand. Paris, 1818, p. 671 (Sur l'Histoire de la Médecine. Cap. 7, III.).

[79] For example: Riverius, Laz., Praxis Medica Lib. IX, cap. 5 (De ventriculi concoctione laesa) in: *Opp. Medica Universa.* Lugduni, 1672, II, p. 136.

[80] Virchow drew attention to Van Helmont as the source of Glisson's theories. "Thus he (Glisson) was led, through a process of "contemplation" to maintain the existence of the "biarchia," the "principium vitae" or the "biusia," the "vita substantialis vel vitae substantia." And in order to allow of no misunderstanding as to the source of his "contemplation" he adds distinctly that this is the "archaeus" of Van Helmont—the "vis plastica" of plants and animals." Virchow, R., The Position of Pathology among Biological Studies. Croonian lecture, Roy. Soc. 16. 3. 1893. *Proc. Roy Soc. London,* LIII, 1893, p. 114.—Willis emphasises the rich nerve supply to the stomach: "hinc ut os ventriculi maxime sensile cum aliis partibus nobilibus, ac imprimis cum cerebro et praecordiis mire communicet, ut non prorsus de nihilo sit, quod Helmontius hic animae sedem collocaverit." *Pharmac. Ration.,* Genevae, 1680, p. 13.—See also Pinel on the influence of the stomach on the brain and the main vital functions. *Philosophical Nosology.* German transl. Copenhagen, 1799/1800, Vol. II, p. 47.

[81] See for example Haworth, Sam., *The true method of curing consumption,* 1682. Charleton, Walter, *Spiritus Gorgonicus s. de causis, signis et sanatione Lithiaseos.* Lugd. Batav., 1650.

historical implications of the three fundamental positions of Virchow's nosology:

(1) The essential identity of physiological and pathological processes
(2) The local origin of diseases in the solid parts of the body, and
(3) The ultimate unit of an organ and tissue as the seat and centre of disease.

The contacts between Jahn and Virchow can be followed up further. Jahn says: There is no organic activity without reflection on the organic substance. For both are bound together by mutual causation and consensus. If therefore disease attacks one well defined locus in the body which reacts to the attack with an active response, organic changes must emerge. These will appear first in the organ immediately involved, then in others with which this is connected by "Sympathy." "There is no disease without Form" (Paracelsus). The anatomical changes are the "Disease-Body." [82] The affected part is being transformed after the life schedule of the pathogenic agent, Van Helmont's "Foreign Guest." It is in this sense that disease was interpreted by the members of the Naturalistic School as a "Parasitic Organisation." The anatomical changes are regarded as "Blastems," [83] a theory which had been elaborated already by Harvey.[84]

"Disease as a parasitic organisation" was the tenet of most "Natur-

[82] Paracelsus, for example: *Opus Paramirum*, Lib. I, cap. 3; ed. Strunz, Jena, 1904, p. 96: "Disease" compares in all respects with "Man." It embraces material elements as well as a special "Astrum," i.e. an active cause which alters the material constituents of the body. Both these form the "Body" of the disease. See also: Zwei Buecher über podagrische Krankheiten; ed. Sudhoff, Vol. I, p. 320 ff. Transl. by Aschner, Jena, 1928, Vol. II, p. 271.

[83] Formation of abscesses especially subacute varieties such as glandular bubones and the "Phyma" is designated as "Blastema" by the Hippocratic writers (e.g. *Epid.* VI, cap. 2). Disease is due to a "Systasis" which, according to Plato resembles the "Physis" of animals (*Timaios*, III, 89: "*πᾶσα γὰρ ξύστασις νόσων τρόπον τινὰ τῇ τῶν ζώων φύσει προσέοικε*"). Obviously this is said of "genesis" ("constitution") and not of "course" of disease, as interpreted by A. E. Taylor, *Plato Timaeus and Critias*. London, 1929, p. 96.

[84] Harvey compared the life of fungi and parasitic plants upon trees with the life of the fetus and also the tumours of the human body such as Cancer, Sarcoses, Melicerides which are nourished and grow through their own vegetative principle while the rest of the body melts away. This is because the autonomous life centre of the tumours actively attracts and defrauds the other—the "true and natural"—parts of the body of their nutritious juices and proper genius. Hence the names: Lupus and Phagedaena. The active parasitic principle may act as "*Contagium*," a *generating* agent, responsible for transmission i.e. generation of the same disease in other individuals. *On Gener.* 27. Exerc.; transl. Willis. 1847, p. 283. Hence the vascular supply of organs and tumours (including granulation tissue) resembles the stalk of a bunch of grapes, the twig bearing buds or the straw bearing ears (*ibidem, loc. cit.*, Exerc. 19, p. 253).

philosophen." This theory actually contains two important nuclei which must be taken into consideration when a comparison with Virchow's ideology is attempted:

(1) The emphasis laid on the morbid-anatomical changes and its origin in the principles of the Naturalistic School

(2) The "ontological" concept of Disease; disease is no disturbance of function, i. e. of balance and harmony alone, but an "Ens" with a life-schedule of its own. This is recognisable

(a) in the anatomical changes, the "Disease-Body"

(b) in a functional disorder of the process of nutrition.

In both points we are bound to recognise fundamental principles to which Virchow subscribed. Nothing need be said as to Virchow's appreciation of the morbid anatomical changes. What is perhaps less obvious is that he made the ontological concept of disease his own. To him the morbid cell is the "Ens Morbi," i. e., the disease centre from which all symptoms and influences on other parts are derived. In this respect the morbid cell and the blastema which it generates constitute a "parasitic" organisation. This is most evident in new growth. Virchow says bluntly that here the point of view of parasitism to which the older authors adhered is fully justified.[85] Indeed, each new growth must be regarded as a parasite towards the body which does not contribute useful elements to it. Virchow recalls that the concept of parasitism is but gradually different from the concept of autonomy accorded to each part of the body. Each individual epithelial and muscle cell, each corpuscle of cartilage or fibrous tissue leads a sort of parasitic existence at the expense of the rest of the body, just as each individual cell of a tree has a particular existence in relation to the other cells of the same tree and deprives them of certain substances for its own purposes. Hence parasitism in the strict sense follows from the autonomy of the individual parts. The degree of their autonomy, however, varies greatly. Certain elements such as the ganglion cells can exist

[85] To quote only a few: Kielmeyer, Kieser, Hartmann, Kreysig, Friedlaender, Meckel, Stieglitz, Autenrieth, Steinheim. It was given particularly poignant expression by the poet Novalis: "Polyps, Granulations, Cancer, Gangrene are complete parasites or Plant-Animals; they grow, they are generated, they are endowed with organisation, they secrete, they eat." *Fragmente* (Philosophy & Physics), Works ed. Tieck and Schlegel, Berlin, 1826, 4th Ed. II, p. 125. Complete Edit. by Kamnitzer. Dresden, 1929, No. 2249, p. 703. Compare J. W. Ritter: "Epidemic Diseases appear to break out especially in spring. Being animals they revive at this time like all other organisms. Infection should be considered as a process of reproduction." *Fragmente eines jungen Physikers.* Heidelberg, 1810, No. 452. See Pagel, W., Religious Motives in XVIIth Century Medical Biology. *Bullet. Inst. History Med.*, 1935, III, 286 ff.

only in continuous symbiosis with the body. Others such as ciliated cells, leucocytes etc. can be separated from it for a long time without losing life or properties. A mobilised element of the connective tissue, migrating and settling down at a different place behaves almost like an Entozoon which invaded the body from outside. The mobile cell cannot establish its new existence unless it derives its food from the neighbourhood, in other words unless it behaves like a parasite. This explains why an Entozoon can insert itself into a body foreign to it as if it were a part of the latter, and further why the more heterologous tumours whose strange formations have misled so many observers, have been often regarded as entozoic beings. As long as a part of the body displays a function useful to the latter, it cannot be called a parasite. It can, however, as soon as it assumes a foreign or noxious character. Hence the notion of parasitism should not be restricted to an individual group of tumours, but covers all plastic-formative-products particularly the " heteroplastic " tumours which, in their further development, produce new formations which are more or less inadequate to the composition of the body.[86]

In Virchow's ideology, however, recognition of the ontological character of disease, its parasitism, cannot mean that it introduces elements which are really foreign to the body. It is always one cell or group of cells of the same animal which act as centres of the morbid process. Were it otherwise, the law of the essential identity of the physiological and pathological processes would not hold.

Virchow pointed out the fundamental difference between " Parasitism " as an anatomical and as an aetiological concept. He says [87] that Stark, the founder of the Naturalistic School called disease a " Parasite " thereby indicating a " life process which often exhibits essential properties of Life." Schoenlein subscribed to this view, but it was his pupil Jahn who emphasized and elaborated it. He defined disease as an " independent primitive life process and organism,"—a parasitic " organisation." This theoretical view was in no way responsible for Schoenlein's discovery of the fungus causing Favus. For to parasitism as " ontological theory " the *disease itself*, not its *cause* represents the *Parasite*. This is a foreign organism which lives, as Stark said, " at, in and with " the body. In Virchow's opinion the discovery of the micro-organisms as pathogenic agents in diseases caused a never ending muddle by which " Essence " and " Cause " of disease, in other words morbid anatomy and aetiology,, were hopelessly mixed up. The essence of disease Virchow sees in a changed

[86] *Cellular-Pathology*, 4th Ed. 1871, p. 545.
[87] *Hundred years of General Pathology*. Berlin, 1895, p. 22.

part of the body, i. e. a changed cell or a changed aggregate of cells (tissue or organ). In this sense he feels himself to be decidedly " Ontologist " and deserving of credit for having reconciled the purely scientific point of view with the ancient but justified postulate that disease is a living entity leading a parasitic existence. For indeed each part of the body acts as a parasite on the rest of it.

The " Naturphilosophen " and members of the Naturalistic School are not so certain about this point. In their opinion it follows from its parasitic character that disease is a reversion to lower forms of life, to " foreign life which plays with our body." It is not only the disturbance of nutrition—as in Virchow's nosology—by which disease is marked out as a " Parasitic Ens." It is seen as a real parasite, a foreign individual which enters the body, a contagium not unlike Ento- and Epiphytes of plants, hydatids, worms. The parasite represents primitive forms, shadows of life,[88] lower monads which are endowed with dim presentiments and dreams of the higher integrations of Life. They exhibit biological phenomena which are reminiscent of those observed when infusoria are formed. These are beings which cannot exist by themselves, they participate in the life of another being. Hence diseases are creatures which through the lack of proper individuality tend to be received into the " life-root " of real individuals.[89] One may find in all this a vision of the microorganisms and their role in the causation of disease. It certainly recalls the gradation of monads which Leibniz founded on the clearness of perceptions and the varying degrees of organ formation. We have endeavoured to show how this was preformed in Van Helmont's concept of the stages of " Impressions " and " Imaginations " which account for specific differences between objects and their action by " Consensus " in nature (" Sympathy," " Magic ").[90] Van Helmont also held that primitive monads enter higher monadic aggregates such as the human body and bring about its decomposition gradually. This is Van Helmont's " Magnum Oportet," the chief cause of human misfortunes and disease.[91]

It is from his concept of the parasitic nature of disease that Jahn derives the emphasis laid on a study of *Comparative Pathology.*

We have seen how in Jahn's world the concept of *Parasitism* is con-

[88] " Lebensgestalten," " Lebensschatten," " Wesenatome." Jahn, *System der Physiatrik, loc. cit.*, p. 20.

[89] Paracelsus: " Morbi differunt ab aliis creaturis ex quod non habent propria individua, sed in aliorum radicibus recipiuntur." Quoted by Jahn.

[90] Pagel, W. The religious and philosophical aspects of Van Helmont's Science and Medicine. *Suppl. Bullet. Hist. Med. No. 2.* Baltimore, 1944, p. 31.

[91] *Ibid.*, p. 30.

nected with the *contagious* character of disease. Virchow rejected the interpretation of the parasitic behaviour of disease as due to the introduction of something foreign to the body. Yet, he adopted the idea that disease *qua* parasitic acts like a contagium. One cell or a group of cells form the primary centre of disease and transmit their own morbid inclination to others, i. e. infect them. This is particularly obvious in the group of "Tumores praeter Naturam" which includes proliferative formations such as real neoplasms but also Tubercles, Gummata and other "infectious granulomata." All these were discussed in Virchow's voluminous work "The Tumours."

Virchow says: What is called a "tumour" is actually a colony of many often innumerable small miliary foci, each of which can be referred to a few mother cells. This is the same principle according to which the body is a "State composed of ultimate tissue units" on which Virchow's whole cellular-pathology is based. Just as the whole body, the parasitic tumour appears to us as a unit, but is in reality the sum total of innumerable much smaller units. It is from the concept of the morbid unit and its decisive role in the development of disease that the contagious nature of "tumours" is derived. Virchow believes that in the minute primary focus a substance is formed which acts as a contagium on cells of the neighbourhood. These are involved in the same way as are later on the lymph nodes. The closer the connection between the cells, the softer the tissue, the better and quicker the transmission and growth of the tumour. Tissues such as cartilage and elastic fibres resist invasion for a comparatively long period. Transmission occurs by direct spread from cell to cell either through the tissue lymph or by cellular seminium without interference from vessels or nerves. It can be shown in tubercles that infection is transmitted without the tuberculous and even any living cell of the body.[92] Even in Carcinoma the role of cellular seminium is not yet established. It may be that the cells act as katalysts or "contagia" on the tissue not unlike the spermatozoon acts on the ovum, stimulating the infected cell to proliferation.[93]

Jahn developed a similar concept. We briefly mentioned that the "cell" to which he referred in his earlier work (before 1843) covered more than the cell in the modern histological sense, although it included it. First of all "cellular tissue" meant connective tissue because of its spongy appearance and consistence. It was its microscopical investigation however, on which the theory had been based that *all* tissues consist of an identical ultimate unit: the elementary globule. Such "globules élémen-

[92] *Cellular-Pathology*, 4th Ed. 1871, p. 542-545.
[93] *Ibid.*, p. 259.

taires" had been discovered in "cellular tissue" but also in blood, pus, milk, in the "animalcula" which developed in "infusions" of animal or vegetable substances, in nervous and muscular tissue. In the latter they had already been described by Robert Hooke and Leeuwenhoek (1674), by Cowper (1694), Swammerdam, Stuart (1739) and Prochaska (1778). Milne-Edwards concluded in 1823 and 1826 [94] that there was very little morphological variation between these ultimate globular units of the tissues, although there might be differences in their chemical constitution. In his opinion it was their arrangement and distribution which determined the shape, quality and function of an organ. "La forme du corps vivant lui est plus essentielle que sa matière." Milne-Edward's views had been accepted by Dutrochet who emphasised the uniformity of structure in the parenchymatous organs. Here and particularly in the classical work of Dutrochet to which we referred before (see footnote 55[a] and 56) we have histological data which had established the cellular theory of Schwann and Virchow.[95]

Jahn emphasized not so much the identity of all tissues in their ultimate constituents, but the "cell" as the elementary unit. This makes it particularly conspicuous in basic undifferentiated mucoid tissue. "Parasitic" i. e., neoplastic formations were in his opinion the product of a proliferation of the hypertrophic "cells" of immature ("cellular") tissue. Their structure resembles that which the mother tissue exhibits under physiological conditions similar to the pathological circumstances which caused the tumour. The phenomena at lower levels of life such as seen in lower animals and in the embryo, can be compared with the growth of a tumour. It is here that "cellular tissue" is paramount, the whole organism representing one enlarged cellular-tissue cell, one hydatid.

In a similar way Oken [96] calls the ultimate unit of an organism, the "mucous primary vesicle," an "infusorium." "If the organic fundamental substance consist of infusoria, so must the whole organic world originate from infusoria. Plants and animals can only be metamorphoses of infusoria. This being granted, so also must all organisations consist of

[94] See previous quotations in footnote 56.

[95] Improvement in the manufacture of microscopes and the development of histological technique are the *obvious* conditions which made it possible for the cellular theory to be established. See the recent account of these factors by Schlumberger, H. G., Origins of Cell Concept in Pathology. *Arch Path.*, 1944, XXXVII, 396. The *ideological* preparation of the cell theory, the subject of the present paper, is *less obvious*, but *not* by any means *less important.*

[96] Oken, L., *Elements of Physiophilosophy.* Transl. A. Tulk. London, 1847 (Ray Soc.), p. 189, § 935-942.

infusoria and during their destruction dissolve into the same. . . . Organisms are a synthesis of infusoria. Their generation is none other than an accumulation of infinitely numerous mucous points, infusoria. . . . They are infusorial vesicles that by different combinations assume different forms and grow up into higher organisms."

At these stages of life the purely cellular tissue is not yet superseded, obscured and pushed into the background by the specialised forms of tissue which derive from it.[97]

In this view lower animals are comparable to the embryo in the earlier stages of its development. Jahn designates this as "Harvey's law.[98] It should be remembered that what became known in the second half of the XIXth century as the "Biogenetic Law" of Haeckel was one of the basic ideas of "Romantic Medicine." Between 1794 and 1814, Kielmeyer (1765-1844) had visualised all plants and animals as the products of a continuous progressive evolution and differentiation. He said that the human embryo is, to begin with, fish- or frog-like; then it approaches the form of Cetacea and finally that of the terrestrial mammals proper.[99] In 1824 Ennemoser (1787-1854) postulated that the human fetus runs through the lower animal-stages.[100] He took as his evidence the gradual development of the organic systems from an immature blastema which is reminiscent of the structure of the lower animals. The whole concept was the product of deductive thinking based on the theory of man as the end-point of a continuous series of living beings. Such theories of evolution as well as the high general interest in scientific Embryology grew on the background of Schelling's "Philosophy of Identity" which regarded "Nature" as the continuous development — "objectivation" — of the

[97] Jahn, Physiatrik, *loc. cit.*, p. 55.

[98] "On Generation," transl. Willis, *loc. cit.*, p. 165 Harvey says: All animals resemble one or other of certain animals mentioned before and are procreated in the same manner, or the mode of their generation at least is referable by analogy to that of one or other of them. For Nature, perfect and divine, is ever in the same things harmonious with herself, and as her works either agree or differ (viz. in genus, species or some other proportion), so is her agency in these (viz. generation or development) either the same or diverse. *Ibid.*, p. 251: It is indeed worthy of admiration that the rudiments of all animals particularly those possessed of red blood such as the dog, horse, deer, ox, common fowl, snake and even man himself, should so signally resemble a maggot in figure and consistence that with the eye you can perceive no difference between them. *Ibid.*, p. 235: The appearance of the "Punctum saliens" marks the transition from plant to animal life in the embryo.

[99] Balls, H., Kielmeyer als Biologe. *Arch. Geschichte Med.*, 1930, XXIII, 268. Buttersack, F., *ibid.*, p. 236.

[100] Bremm, J., *Der Tiroler Jos. Ennemoser, 1787-1854.* Jena, Fischer, 1930, p. 90.

mind out of the other natural phenomena, particularly those of lower organic beings and Life at large.

Haller, Wolff and John Hunter had drawn attention to the development of the chick embryo in the ovum and to the parallels with the formation of certain pathological products. The embryological studies, as Virchow said,[101] not only led to a clear conception of development processes, but also awakened the sense for independent observation ("autopsia") and the understanding of the scientific method.

The comparison of embryonic i. e. growing tissue in health and disease with lower stages of animal life is essential for the disease-concept of the Naturalist. For not only tumour formation but *disease at large means to him reversion to lower levels of life such as those exhibited by the embryo or the infusoria, for both have in common the dependance upon the behaviour and fate of one cell.*

According to Virchow disease in general should be attributed to the formation and function of one morbid cell. In the light of the theories of his naturalistic predecessors, Virchow's *Cellular Pathology* may, therefore, be interpreted as the concept of *disease* as a *reversion to lower levels of life.*

A study of life phenomena in the embryo promises in the opinion of the "Naturalist" much information as to the genesis of diseases. Harvey [102] and Van Helmont [103] had emphasised this. Jahn draws attention to the reappearance of "cellular" i. e. embryonic immature mucoid tissue under pathological conditions. Thus formation of pus means reduction of the tissue to living "molecules" not unlike Infusoria. No doubt that these approach very closely, our leucocytes.[104] In the same way Oken had taught that "Putrefaction is nothing else than a division of organisms into infusoria, a reduction of the higher to the primary life." [105]

This reduction of the living tissue into minute units is reminiscent of the structure of mussles in which mucin and albumin are predomnant and, according to K. E. Baer, the body represents a sac filled with infusoria. The disintegration of the whole means for them the obtaining of independent life.[106]

[101] *Schoenlein—Obituary.* Berlin, 1865, p. 13.

[102] See passages from "On generation" quoted before in Footnotes 84 and 48.

[103] When he visualises disease as the "Fructus nempe adulterinus partique dolenti suppositus foetus." Van Helmont, Ignotus hospes morbus 82.

[104] *Physiatrik*, p. 70.

[105] Elements of Physiophilosophy, *loc. cit.*, § 941, p. 190.

[106] *Physiatrik*, p. 134.

It is well known how the comparison with embryological data guided Johannes Mueller in the classification of tumours. He formulated the law of the Identity of Embryonic and Pathological Development. Virchow, his pupil, qualified this law by putting it on a cellular basis. He concluded that neither the embryo nor any pathological formation develop from a "blastema." Both represent generations of dividing cells derived from the ovulum or a pathological cell respectively.[107]

Virchow could base these deductions on the fundamental work of Robert Remak. Nowadays Schwann, Schleiden and Virchow are the celebrated and popular exponents of the Cellular Theory. The significance of Remak's work is much less recognised, but by no means less important In certain respects he deserves more credit than his well known contemporaries. It was his work which established the cell as an individual entity and as the basic unit of tissues. As a result of his labours it was made to replace the vague Blastema, to which even Virchow originally subscribed. Thus the law "Omnis Cellula a Cellula," pronounced by Virchow (1856), was actually conceived and prepared by Remak. Remak's work was actuated by a comparison of cell formation in the embryo and in tumours. Schwann had visualised a development of cells in the embryo not unlike crystals, the nucleus appearing first and forming a centre for the apposition of protoplasm and the cell membrane. New cells were to form either outside or inside the cells. In 1841 Remak had observed the division of blood cells and in 1845 the longitudinal division of muscle cells; in 1852 he had demonstrated that most of the known cells derived from the division of the first blastomeres. Finally in 1854 Remak succeeded to show that the division is not due to a dehiscence of protoplasm, but to the cell-membrane forming a symmetrical indentation and then a transverse septum.[108] It is thus that the cell membrane became a structure of prime importance; its existence in all cells was energetically defended by Remak (particularly against the doubts of Max Schultze). Remak admitted, however, the occurrence of endo-cellular formation of new cells in certain cases.[109]

So much for Remak's discoveries in *normal* histology! In 1854 he demonstrated cell division in tumours.[110] Already two years previously

[107] *Cellular-Pathology*, 4th Ed. 1871, p. 486.

[108] Remak, Robert. *Untersuchungen über die Entwicklung der Wirbeltiere.* Berlin, Reimer, 1851-55.

[109] Remak, R., Endogene Formation von Eiter- und Schleim-Zellen. *Virchows Archiv*, XX.

[110] Remak, R., Ein Beitrag zur Entwicklungsgeschichte der krebshaften Geschwülste. *Goeschen's Deutsche Klinik*, 1854, No. 16.

he had given expression to his conviction that the formation of pathological tissues in extracellular blastemata is just as fictitious as that of normal tissues therein.[111] Pathological tissues originate in normal tissues. There was no growth in which Remak could detect the so called "free nuclei." Where there were nuclei, they were enclosed in cells. A tumor is, therefore, not a new formation of tissues, but a *trans*-formation of normal tissues with the result of elements which, in form and chemical constitution, are either similar to the normal ones (homologous tissues) or by progressive degeneration assume more and more dissimilar features (heterologous tissues). It may be recalled that these observations fundamental to the cell theory as well as to cellular-pathology were made by a pupil of the Naturalist Schoenlein.

Even this theory of disease as a reversion to lower stages of life appears in Jahn's system as the result of a general philosophical view of man's position in the world. The human body appears to be the highest stage of development which nature has achieved. In it all lower forms of life are combined and integrated. There is "instinct" as well as "cerebral life."

We have seen that a morbid process is due to the preponderance of one direction of life, the exaggeration of a normal process so that it appears as if observed through a microscope (Baillie). If therefore, man is a combination of all lower forms of life, and disease an excess of one set of vital phenomena, it follows that disease is the reversion to lower forms of life.[112] Diseases in man are therefore repetitions and copies of what is normal at lower stages of living beings. Such ideas were not peculiar to Jahn. Paracelsus had formulated a similar concept for the explanation of insanity, Meckel for that of malformations, Stark, Carus, Steinheim, Oken, R. Hoffman for diseases at large.[113]

It is not surprising that such speculations invited a number of comparisons which seem to be phantastic to the present day observer, but were probably quite natural to an age in which the study of comparative anatomy and embryology was greatly stimulated by natural philosophy. Scrophulosis was then compared with the life of lower amphibia and cartilaginous fishes. The voluminous abdomen and liver, the pale badly developed muscles and bones, the profuse production of lymph, polyphagia and comparative pallor of blood were taken as common denominators. Fever and inflammation causing a full strong pulse, a red fiery eye, a bright red furry tongue, the excretion of scarce, strongly smelling urine

[111] Remak, R., *Archiv f. Anat. & Physiol.*, 1852, XIX, 57.
[112] Physiatrik, *loc. cit.*, p. 126 ff.
[113] *Ibid.*, p. 131.

and hard, dry faeces were compared to the life of voracious animals or to that of birds; adhesive pleurisy and pericarditis to the physiological adherence of pleura and pericardium in certain animals (such as fishes and amphibia). The enormous size of the liver of mollusca seemed to be comparable to the enlargement of the liver in certain diseases ("polycholia"), a hypertrophic or aneurysmatic heart to the normally large heart of birds, the pathological État Mamelonné of the human stomach to the normal stomach of the horse, human gastrectasy to the normal condition of the stomach in worms and caterpillars, obesity to the physiological condition of whales, emphysema of the lungs to the air sacks of the pupa of butterflies, to the air bladder of the fishes, the air containing abdomen of cephalopoda. Malformations such as a double penis and clithoris, three testicles etc. have physiological paradigmata in animals such as certain worms, insects and salamanders. Atrophy of organs is reminiscent of the condition of animals in which these organs are not developed yet. Passive venous congestion corresponds to the normal condition of the blood of diving, digging and hibernating animals which can live with a minimum of respiration. Blood in chlorosis is not unlike the thin fluid found in snails, fishes and amphibia, and the small heart, scanty vessels, incomplete organisation and low temperature of blood, the whitish soft flesh and the predominance of "plastic" tissue are further parallels between the chlorotic human being and these animals.

In a similar way pathological formations are reminiscent of certain embryonic structures: Tubercles and Hydatids of Blastocoels. The normal blood condition in the embryo is that of passive venous congestion in the patient with circulatory failure. The heart in the newborn corresponds in size to a pathologically hypertrophic heart in the adult. The new born infant exhibits tachycardia as a normal phenomenon. It shows a richness in capillaries and a patent Foramen Ovale.

All these comparisons are based on the concept of disease as a reversion to most primitive stages of life, a concept which was reduced by Virchow to the empirical and scientific principle of cellular pathology. The philosophy from which this concept sprang does not remain recognisable in Virchow's work. If we wish to acquaint ourselves with it we must go back to the Natural-Historical and Natural-Philosophical Schools.

(5) *The Naturalistic System of Disease.*

To the members of the Naturalistic School in medicine natural history was no end in itself. They collected biological data in order to prove

certain speculations in disease and above all to base on them the system by which all diseases could be classified like plants or animals.

We mentioned Schoenlein's yearning for a nosological system. However undecided and careful he was about its final formulation the three divisions of " Morphes," " Haematonoses " and " Neuronoses " remained.

We find the same system in Jahn's work.[114] It is *the* system of the Naturalistic School and no doubt it forms a continuation of the nosological systems of the " Naturphilosophen."

The system is based on a *histological* classification. Tissues are " systems of organisation." The Naturalist differentiates three such fundamental tissues: (1) the " Animal Matter " at large which covers connective tissue, membranes, lymphatic tissue and glands, (2) " Blood system " which embraces (a) cardio-vascular organisation and (b) muscular tissue, and (3) " nervous system " which consists of (a) the central, (b) the peripheral ganglion systems. Three forms and directions of vital functions (" Life ") correspond to these three systems of organisation: (1) " Vegetative Life " which is devoted to plastic reproduction and secretory processes. (2) " Animal Life " which governs the distribution of blood and " Irritability," and (3) " Sensitive Life " as embodied in nervous activity.

As we have seen at the outset each life process oscillates between two " poles." Either it follows unchecked its own bent and spontaneity—the egotistic pole—or it is submerged in and finally overcome by other life processes to which it is, of necessity, correlated—the altruistic (universal) pole. These two polar directions find their specific expression and organisation in the three spheres of the vegetative, vascular and sensitive life. In the vegetative sphere the pursuit of the egotistic tendencies leads to accentuation of the innermost nutrition, to organic crystallisation, to apposition and fixation—whereas secretion, excretion, liquefaction and demarcation indicate tendencies towards the " universal " pole. The centrifugal movement of the arterial blood represents the " egotistic," the centripetal movement of the venous blood the " universal " tendencies in the " vascular sphere." Nervous activity and the intervals of rest are the corresponding members in the " sensitive spheres." Harmonious balance between the leanings towards these poles means health, preponderance of either leads to disease. An " egotistic " excess of vegetation will cause hypertrophies, scrofulae, tumours in the widest sense, scirrhi, an " altruistic " excess (or too little spontaneity) colliquations such as

[114] Jahn's representation of the " System " is given in " *Die Naturheilkraft in ihren Aeusserungen und Wirkungen. Vorarbeit zu einer zeitgemaessen Umgestaltung der Heilkunde.*" Vol. I. Eisenach, 1831, p. 228 ff.

Blenorrhoea, Diabetes, Hydrops.—" Erythroses " such as congestion, inflammation and arterial haemorrhage on the one hand, " Phlogoses " such as venous congestion, haemorrhoids, scurvy, purpura are the corresponding members in the vascular sphere, and those in the nervous sphere are Rigor, Algias, and Insanity as opposed to Paralysis, Apoplexia, and Amaurosis.

The Naturalistic School was blamed for this system because of its obvious shortcomings and for having established a system of diseases at all. At first sight, just this part of Natural-Historical teaching in medicine seems to have had no influence whatever on its scientific successor.

This is not so. Virchow said: [115] the impartial critic must admit that this system is wrong only where applied to the complex diseases in special pathology, but that it is essentially correct when limited to the elementary processes which form the subject of general pathology. Here *the groups will correspond to the differentiation of " Formative," " Nutritive " and " Functional " Disorders.* This is Virchow's well known classification at which he arrived on account of a study of the three fundamental directions of *cellular* activity.[116] In Virchow's opinion, the Naturalistic School was right in representing the Nutritive by the blood and the Functional by the nervous system. In addition the Natural Historians had a good insight into the primordial " mucoid " and " granular " (i. e. cellular) tissue as the initiator of all organic formation.

(6) *Jahn's Actual Anticipation of Cellular Pathology (1843).*

We have endeavoured to show how closely Jahn's nosology approaches the ideological superstructure of cellular pathology. So far only Jahn's work prior to the discovery of the cell in the modern sense by Schleiden (1838) [117] and Schwann (1839) [118] has been considered. The contact between Jahn and Virchow becomes even more striking in a paper by the former which appeared in 1843; that was two years before Virchow published his first studies which were on special pathological subjects, and fifteen years before the first edition of " Cellular Pathology." Jahn's paper was entitled: " Disease as a parasitic organisation." [119]

[115] Schoenlein—Obituary, *loc. cit.*, p. 22.

[116] *Ibid.*, p. 71 and *Virchow's Archiv*, 1858, xiv, 13; *Cellular-Pathology*, 3rd Edit. 1862, p. 268.

[117] *Contributions to Phytogenesis.* Transl. by H. Smith. London, 1847.

[118] *Microscopical Researches into the accordance in the structure and growth of animals and plants*, London Sydenh. Soc., 1847.

[119] Die Krankheit als Afterorganisation. *Haeser's Arch. f. d. gesamte Med.*, 1843, v, 354-400.

Parasitism, says Jahn, is the common denominator of *all* diseases. Their main characteristic is the splitting up of the body into a healthy and morbid part, the abolition of its functional unity, the establishment of a double life. It partly follows its innate laws, its original type and idea; partly it acts as if it aimed at its own destruction. Even here, however, it obeys a type, idea or plan, for there is no vital process without such schedule of function. Hence morbid symptoms constitute a special type of vital process, an entity which Sydenham designated as a morbid " Species."

Morbid-anatomical changes are expressions of the formative potentialities which any vital process displays. In this way, the morbid vital process acts as a formative principle out of a formative impulse, as does any other vital process. It creates its own instrument either by conversion of pre-existing parts into pathological formations or by production of new—heterological—elements. In other words it acts as an *organiser*.

The new cellular physiology Jahn continues, has shown that very little is needed for *organisation*. A single primordial cell can represent the whole organism. The lowest beings, for example the yeast-germs which Schwann had discovered, consisted of nothing but a single primordial cell. At higher levels of natural development the organisms are nothing but aggregates of a few or several primordial cells which need not even be in continuity or enveloped by a common capsule.

Surely, says Jahn, *such organisations can be demonstrated in all diseases*. For certain it is that even where diseases produce no additional elements, for example in atrophy and paralysis, the original organ-cells are subject to pathological changes. According to what has been said, even a single primordial cell undergoing a pathic metamorphosis must be regarded as a parasitic organisation. For the majority of diseases already new pathological elements have been detected: corpuscles in exudates, pus and inflammation.[120] The blood cells exhibit alterations in typhoid fever, chlorosis, scrofulosis, scurvy, alcoholism etc.

Diseases thus appear as individual entities with own life centres, with self-preservation and self-reproduction, as far as the organic cells themselves can claim the prerogatives of individuals. This, however, has been proved by the discoveries of Schleiden, Schwann, Henle[121] and Sobernheim.[122]

It is, therefore, not surprising that progress, extension and transmission of diseases follow the same principles as the generation of the

[120] *Loc. cit.*, p. 358 ff.
[121] *Pathologische Untersuchungen.* Berlin, 1841, p. 44.
[122] *Arzneimittellehre*, Vol. I, p. 1 ff.

lowest living entities, for example, of the fungi in which each particle acts as seed.[123]

Jahn concludes: *Everything in the body consists of cells. There is no dynamical disturbance of organisation without material changes. Hence any morbid change must be referred to a change in those elementary constituents.*

This is cellular-pathology in general outlines. It was Virchow who filled in the empirical material and thereby made a natural philosophical theory acceptable to a scientific age.

We are here concerned with historical facts, not with attempts at distributing prizes. Whatever the opinion as to the merits or faults of theories and systems, the fact remains that cellular-pathology was visualised by a prominent exponent of the Natural Historical School before Virchow. Jahn's paper could not have escaped his attention, though perhaps it has not influenced the direction of his empirical research. It should be remembered, however, that Virchow, actuated by a deep interest in the philosophy and history of medicine, drew attention to the assets of the Natural Historical School at a time when its theories and systems were no longer taken seriously.

IV. Criticism and Rehabilitation of the Naturalistic School.

The weakness of the system of diseases presented by the Naturalistic School, particularly the wide use which it had made of speculation and analogy, were too obvious to escape the criticism of the contemporaries. Medicine had been oversaturated with the ideas of the "Naturphilosophen." This called for drastic purification which was at first based on a logical analysis of their methods. It was arm-chair work rather than the discovery of new facts which brought about the discouragement and obliteration of naturalistic speculation. Lotze and Henle may be quoted. The concept which was attacked by all critics was that of parasitism. It was emphatically denied that disease could be designated as a parasite. Lotze said:[124] True parasites (Entozoa) are organisms, not diseases. They carry their essential characteristics in themselves. It is quite immaterial for them as such whether they find the external conditions enabling them to develop in other bodies. The vital phenomena emerging in

[123] Jahn refers here to Langenbeck's experiments in *Schmidt's Jahrbuecher*, 1840, xxv, 99.

[124] Lotze, H., Review of C. W. Stark, *Allgemeine Pathologie oder allgemeine Naturlehre der Krankheiten* (1839). *Hallesches Jahrbuch f. d. Wiss. und Kunst*, II. Leipzig, 1839, p. 1545-1592. In Lotze's *Kleine Schriften*, 1885, Vol. I., p. 26 ff. part. p. 36 and 40.

pathological conditions are due to disturbances in the course of healthy life, i. e. of physiological functions; the changes in sensation, motion, metabolism etc., i. e. the essential characteristics of disease are not as it were constituents or parts of the parasite, but phenomena of the life which happens to be disturbed.

In 1841 Jacob Henle gave a new foundation to the ancient theory of the " Contagium animatum " by collecting the scientific evidence in favour of it up to this time. When doing so, he emphasizes that this theory is not really identical with " a pathological theory which, a remnant of Natural-Philosophy, still finds many adherents of great influence in Germany, a school which regards not the contagium, but the disease as a parasitic organism or more ambiguously still as a parasitic life process. The contagium is said to be the germ or seed of this parasitic being, by means of which it propagates itself. . . .

In spite of the consistency with which the theory has been pursued into detail, I have always regarded it as an ingenious, nay sometimes jocular comparison rather than an explanation. Here it may suffice to point out the main difference between contagium as I understand it and the living disease—germ or seed of the School mentioned: in my theory it is not the disease but its cause which propagates itself." It is noteworthy that, without mentioning him, Henle uses here Van Helmont's simile of the " Spina infixa." In order to adduce a " rough example," Henle says, a thorn which has pricked a finger may cause suppuration and removed from this and transferred to another person's finger cause the same therein. It is, therefore, not the disease or a product thereof, but the irritant causing it, which has been transmitted, and provided the thorn could multiply in the body or each of its smallest part become a thorn again, transmission of its smallest particles could elicit the same disease, i. e. suppuration and inflammation in other individuals. In other words, the disease is not the parasite, but the thorn, and diseases are similar to each other, because their causes are similar.[125]

Five years later Henle continues in the same vein. The Entozoon is just such a little disease organism as the dog which bites into somebody's leg or the larva which enters the skin. Even if spontaneous generation of entozoa could be demonstrated in the host, the parasite would represent a now independent product of the body, but not disease itself. " What, if it could be shown that a disease, at certain periods, leaves the body of the host in which it was born, enjoys itself in the water, grows and metamor-

[125] Henle, J., *Pathologische Untersuchungen*, Berlin, 1841, p. 15 ff. English translation by G. Rosen. Baltimore. Johns Hopkins Press, 1938, p. 17.—On Van Helmont's " Spina infixa," see: Pagel, W., *J. B. Van Helmont*. Berlin, 1930, p. 76, 121, 211.

phoses itself without bothering about the patient any longer. Would the advocates of the emancipation of disease regard this as a misuse of its liberty?" [126]

But when discussing the significance of the discovery of the cell for the contagium animatum, Henle cannot help admitting, in 1841, that no differences between the cell of the host and the contagium can be found, unless the latter happens to be motile. For, as Schleiden's and Schwann's discoveries have shown, the most divergent organic formations are identical at the very early stages, when they appear in the form of granules or droplets which become discs or cells, forming the nucleus for a second cell, surrounding it and so forth. The animal and plant body is an aggregate of such cells which develop in various directions, while on the other hand, primitive plants and probably also animals may remain a single or a complex of very few cells. The elementary units are thus endowed with a certain measure of independence. Individual cells which have been removed from a living aggregate may survive—provided they find suitable conditions, for example in another aggregate of units, i. e. an animal or plant. Hence contagiosity could be explained by a morbid change of the elementary units and their ability of growing and reproducing themselves in other bodies and at their expense. It seems to be in this way that transmisison takes place from one part of the body to the other in neoplasms which have been called parasitic, because the independence of pathological tissues were so striking therein. Pus globules are being absorbed by the veins like small foreign bodies and can be carried along until the narrow lumen of the capillaries stops them from circulating. Pus globules from the pulmonary veins, then, elicit stasis and inflammation in the areas supplied by the greater circle, and those from the peripheral veins in the system of the pulmonary capillaries.

If instead of pus globules tubercle cells are transmitted into the blood, not simple inflammation and suppuration but also tubercles will develop, as tubercular tissue cannot be denied the ability of growing at the expense of adjacent tissue. It is perhaps in this way and not by the generalisation of a dyscrasia that in advanced phthisis tubercles develop in the intestines, the serous membranes and the bones so commonly." [127]

The contagiosity of tumours including warts, condylomata and tubercles is thus to Henle a problem of tissue transplantation; engendered by an initial dyscrasia a local tissue change occurs—a " parasitic tumour " which grows and propagates itself by means of transplantation of its morbid elements either in the same or to another body.

[126] Henle, J., *Handbuch der rationellen Pathologie*. Vol. I. Braunschweig, 1846, p. 71.
[127] Pathologische Untersuchungen, *loc. cit.*, p. 45 ff.

Henle does not want to advance this in a dogmatic form. It means to him no more than a hypothesis which may possibly explain the contagiosity of many neoplasms. Beyond the assumption that the contagium is a lower animal, plant or a germ, the possibility must be envisaged that it may be a morbid elementary unit of the individual from which infection starts.

In Henle's opinion this is not very likely in infectious diseases of man and animals, as their body-elements are unable to maintain life outside the organism for any length of time. But the possibility exists and the problem can be only decided by an investigation into the common occurrence of contagia outside or inside the animal body. If contagia could be shown to develop in the body subsequent to any disease, they are likely to be elementary units of the body and probably not independent animals or plants.

Twelve years later, when Henle published the third volume of his "Handbook of Rational Pathology," he was even more definite in regarding the conversion of tissue elements into "Parasites" as unlikely.[128] But to formulate this possibility at all meant to offer the theories of the "Naturalistic School" a chance, and it was precisely this supposition that tissue elements might behave like parasites towards the rest of the body through which Virchow rehabilitated the ontological disease concept of the Naturalists.[129] At the same time Virchow opposed fundamental tenets of Lotze's and Henle's nosology: particularly the concept of disease as a generalised disturbance (dyscrasia) from the beginning.[130] He maintained the localistic point of view [131] and emphasised the danger to the life of the whole associated with the presence of the morbid cell. It was just this idea of "danger" which Lotze had rejected in favour of a purely mechanistic theory of disease as a phenomenon of abnormal movement of material particles.

It is worthy of note that the concept of the Naturalists was rejected on *theoretical* grounds by the medical *thinkers* of the time, but revived on *empirical* evidence by a *histologist*. Once again speculation and imagination had anticipated the results of scientific investigation.

[128] *Handbuch der rationellen Pathologie*, Vol. III. Braunschweig, 1853, p. 467.—On p. 480, however, again a qualified admission of similarities between "contagia" and isolated tissue elements, particularly tumour cells.

[129] See before footnotes 86 and 87.

[130] See Diepgen, P., Krankheitswesen und Krankheitsursache in der spekulativen Pathologie des XIX. Jahrhunderts. *Arch. Gesch. Med.*, 1926, XVIII, 302 (partic. p. 309 ff.).

[131] This and not the cellular theory was, in my opinion, the starting point of Virchow's early research in the forties of the XIXth century. See Pagel, W., Virchow, *loc. cit.*, Jena, 1931, p. 17 and particularly 23 ff.

HYDROPHOBIA: ITS HISTORY IN ENGLAND TO 1800

CHARLES F. MULLETT

The importance of hydrophobia in medical history has long been recognized, and all too frequent news reports make plain the continuance of the menace. If the threat and proportions do not equal those of a century and more ago, it is still clear that hydrophobia remains unsolved. Indeed a recent study by a well-informed investigator emphasizes the prevailing ignorance of the disease wherein the lay literature mixes sound fact, valid hypothesis, and speculation.[1] He himself has gone far to correct the situation of which he complains. The following pages, by contrast, discuss the popular and learned concern with hydrophobia in England during the first century and a half of persistent and diverse if not always intelligent consideration. The materials are extensive, bulky, and varied. Though no complete bibliography will be attempted, such references as have been discovered will be enumerated and both books and fugitive pieces will receive attention. Before conducting this survey, however, a sketch of present knowledge may be useful.

Hydrophobia has aroused the concern and challenged the ingenuity of men at least since the third century B. C. Bolos-Democritus discussed it; the encyclopaedic Dioscorides in the first century A. D. in his *De Materia Medica Libri Quinque* mentions the roasted liver of a mad dog as a remedy for those who have been bitten to prevent them from becoming afraid of water;[1a] his contemporary, Celsus, prescribed suction of the wound and thorough cauterization, a treatment that was not improved upon before Pasteur's time and was the core of many regimens in the intervening period; Galen recommended excision; and doubtless many other accounts appeared during the next several hundred years. The earliest modern work seems to have been *Tractatus de Maculis Pestiferis; de Hydrophobia* (Basle, 1577, 1644), by the Italian physician, Jerome Mercurialis (1530-1606). A decade later, A. Mancinellus produced *Floridum Opusculum . . . de morsu canis rabidi ejusque curatione*

[1] Leslie T. Webster, *Rabies* (New York, 1942). This work is the chief source of the descriptive information in the first few pages of this article.

[1a] Book II, Chapter 49. A treatise on remedies for the bite of animals which included a chapter *Notae rabidi canis eiusque in homine morsus*, not written by Dioscorides, was attached to his name in the 7th or 8th century and included in some Renaissance editions of his *De materia medica libri quinque*. Cf. Bibliotheca Osleriana, Nos. 336 and 339.

(Venice, 1587), and in 1610 *De Rabie, hydrophobia communiter dicta, libri duo*, by another Italian physician, B. Codronchi (1560?-), was published at Frankfort. Thereafter the problem stimulated an extensive literature, with continental writings outweighing the English contributions in bulk and in value for some years. Once English interest was thoroughly aroused, however, the subject received widespread and learned discussion.

Notwithstanding all this attention one competent judge has said that up to 1880 all sound knowledge could be summarized "in a very few pages." The method of Celsus, though by no means adequate, lost its fullest efficacy through lack of speed, courage, and thoroughness. Bleeding, heat, mercury, curare, and electricity were common remedies, but because of "far from unimpeachable" evidence the consequences remain a mystery. Meanwhile, at first circumscribed in a few areas, the disease spread throughout the world and at times assumed epidemic proportions. Occasionally found in herbivorous animals, more rarely in birds and swine, it has flourished among carnivorous animals where it always has originated.[2]

From 1800 to 1880 men proved the contagiousness of rabies experimentally and by 1870 began to appreciate the significance of mucous and saliva. In the winter of 1880/81 Pasteur first saw the possibility of vaccinating dogs and thus aiding man. He showed that the causative agent existed in a relatively pure state in the central nervous system alone and that the virus was present in the brain as well as the saliva of rabid animals. Close studies of rabbits disclosed them to be very useful reagents because their madness was "dumb" in contrast to the "furious" madness of dogs. Continued passage from rabbit to rabbit altered the agent; drying weakened it; and the weakened agent could be used as a vaccine. In reporting his experiments and methods Pasteur declared that in 1726 persons inoculated there were only ten failures.[3]

Without in any sense disparaging Pasteur's achievements Webster warns that vaccination for hydrophobia needs restudying and evaluation.[4] The facts so far available come from controlled laboratory experiments. Though essential, these cannot equal in value uncontrolled field observations. "Under no circumstances, therefore, can failure to develop rabies

[2] Renaud Suzor, *Hydrophobia, an Account of M. Pasteur's System containing a translation of all his communications on the subject, the technique of his method, and the latest statistical results* (London, 1887), 1-3.

[3] Webster, *Rabies*, 45-46; Suzor, *Hydrophobia*, chap. ii.

[4] Webster, *Rabies*, chaps. ix-x.

be credited to vaccination without ample evidence that without it rabies almost certainly would have developed." Early immunization practice proved useless and "critical data on the immunizing potency of rabies vaccines have not yet been found in the field." The vaccine should possess a definite immunizing potency, the amount yet to be determined, and exposed persons should receive only vaccines proven potent. Following known exposure physicians normally treat the bite with nitric acid and then vaccinate; yet the effect of nitric acid on rabies virus is not certainly known. Vaccine is recommended where the skin is broken or in direct contact with the saliva.

Rabies itself is an infectious disease with a characteristic pattern, caused by a virus which attacks the nerve cells. There are different strains of virus and there are carriers who go untouched. The virus causes rabies when after the bite it penetrates to the nerves and thence extends to the brain. It progresses by nerves rather than by blood and once it reaches the spinal cord or brain the victim is doomed. The presence of foreign bodies in the stomach has no significance, but lesions, nodules, Negri bodies in the nerve cells have great value in diagnosing the presence of rabies, diagnoses being made through clinical, histological, and biological techniques.[5]

Diagnosis is of course especially significant in anticipating danger. Behavior should be closely observed, for any change in disposition, not necessarily for the worse, excitement, and perverted appetite bear serious attention. Symptoms are both typical and atypical. In man they usually include tingling soreness, restlessness, irritability, melancholy, hallucinations, excretions, coughing and paralysis. The intelligence may remain unimpaired; indeed, during the agony the victim's intellect may brighten and his sentiments become more vivid. Yet "the mere sight or mention of water sets off contractures of the larynx, prevents all breathing." The incubation period may range from ten days to two years, with the average running about two months. Incubation comes quicker in children but older persons die in greater numbers. The disease endures from one to eight days and recovery is rare; many who escape commit suicide. According to one authority, the death rate amounted to 30% after early and efficient cauterization and to 80% where no cauterization was applied; hot iron, acids, antimony, and mercury are effective in this capacity. In the acute stage instead of administering morphia which aids the virus, the doctor should prescribe drugs which help the nervous system. Hydro-

[5] *Ibid.*, chaps. ii-vi.

phobia in man may be either "dumb" or "furious," the latter being far more common. It can be, and often has been, confounded with hysteria, epilepsy, and related behaviors.[6]

The behavior of a rabid dog also falls into a pattern.[7] He is usually agitated, snapping at everything in his way. His saliva is virulent at least eight days before acute symptoms set in. He has no horror of water but cannot swallow, and a complete perversion of appetite soon occurs. His bark becomes hoarse and veiled; the sight of another dog sends the mad dog into a frenzy; he becomes insensitive to ordinary pain; his sex instincts are excited; and exhaustion and paralysis of the hind quarters are characteristic. Submersion, bleeding, and enemata have cured rabid animals. Rabies disappears from a community in the face of strenuous preventive measures, such as inoculation and muzzling, but returns with their relaxation. Man has never contracted hydrophobia except from a rabid animal, but his susceptibility is not even yet precisely known. Dogs are involved in nine cases out of ten, largely because they are so intimate with man and because their most characteristic defense, attack, or play is biting.

With these points in mind it will perhaps be easier to follow the somewhat confused variety of descriptions, analyses, and recipes narrated below. At times it will be apparent that the observers of the seventeenth and eighteenth centuries were far wide of the mark; at other times it will be equally clear that considering their technical equipment they had shrewd notions of how to combat a disease that because of its nature created psychological as well as physiological problems. In any case, on the basis of the evidence to be submitted, no one can deny that physicians and laymen alike gave the fullest consideration to a most fearsome pest. Their failure to achieve a satisfactory solution cannot be laid to lack of effort or to shortage of observable data.

Apart from some references in the general health books of the sixteenth century the first English accounts seem to have come from Dr. Thomas Spackman in 1613, *A Declaration of such greivous Accidents as follow the Biting of Mad Dogges* and [*Of a Mad Dog's Biting and the Cure?*]. Interest then strayed for some time, but toward the end of the 17th century the promptings of the Royal Society inaugurated a voluminous literature which after 1730 reached extraordinary proportions. Reports of rabies, crusades against loose dogs, and a torrent of recipes filled the

[6] Webster, *Rabies*, chap. i; Suzor, *Hydrophobia*, 18-26.
[7] Webster, *Rabies*, chap. iv; Suzor, *Hydrophobia*, 9-15.

periodicals, and the communications to the Royal Society and specific treatises on the subject supplied additional evidence of the widespread concern.

Robert Boyle drew the first attention of the Society to the matter in 1666 by proposing some inquiries concerning the sea, notably its medicinal virtues against hydrophobia.[8] Nearly twenty years later (1683), Martin Lister more single-mindedly related the case of "a man bitten by a mad dog and dying of hydrophobia."[9] In this instance the wound had healed after the bite and the episode was forgotten; six weeks later, however, the victim complained of pains in his back and stomach. After three days he took to his bed. On drinking brandy he vomited; he then became rapidly worse, unable to retain food or drink, and developed a fever. He was bled, plastered, and dosed with theriac, to no avail. Soon he assumed the posture of a dog and lapped liquid. Convulsions followed, for during the whole period he neither went to stool nor passed urine and was, in addition, afflicted with a painful priapism. His spittle was infected with canine poison.

In his account Lister referred to other cases and in 1698 he reported specifically concerning two boys affected by a mad dog in 1679.[10] The boys had handled a dog wounded by a mad dog though the particular dog petted did not become mad. Six months later the boys became ill, with acute stomach pains, following which they had convulsions and began to bark and snarl. Dosed with antimony and mercury, treacle, crab's eyes, and other standard cure-alls, they recovered, but the older boy had since had fits. Lister also manifested his interest by including a section on hydrophobia in his *Sex Exercitationes Medicinales de Morbis Chronicis* (1696, 1698).

Meanwhile, other members contributed reports. Roger Howman, physician at Norwich, described in 1684 "a remarkable case of hydrophobia." A man bitten by a mad fox complained after six weeks of pains in his back and elsewhere. He had had many stools and became paralytic. The bites had healed after profuse bleeding but the victim suffered from

[8] *Philosophical Transactions*, I, 315; *The Philosophical Transactions of the Royal Society of London, from their commencement, in 1665, to the year 1800; Abridged, with notes and illustrations, by Charles Hutton, George Shaw, Richard Pearson* (18 vols., London, 1809), I, 118. I have used the latter throughout but shall cite both sources as *Phil. Trans.* and Abr. Wherever necessary and possible I have included a brief biographical notation on each author.

[9] *Phil. Trans.*, XIII, 162; Abr., II, 608. Lister (1638?-1712), physician and natural scientist, had an extensive literary output.

[10] *Ibid.*, XX, 246; Abr., IV, 286.

fever and a rapid pulse; although he retained his reason his voice was broken and he had great fear of water.[11] The growing interest also stimulated members to submit receipts never known to fail. Sir Robert Gordon's cure for mad dogs and bitten men or beasts in 1687 called for roots, crab claws, treacle, and milk, boiled together.[12] Sir Theodore de Vaux communicated a note from the papers of his godfather, Theodore Mayerne, on the diseases of dogs with several receipts similar to Gordon's for curing their madness and those bitten by them, and listed such cures as putting the bare breech of an old cock to the wound.[13]

Daniel Turner in 1693 summarized the case of a child whose wound had healed after the discharge of laudable pus, but who soon became feverish, developed canine hoarseness, and foamed at the mouth; no remedy proved effective.[14] A "noble and infallible" recipe from George Dampier (1698) was no more than a concoction of herbs; and Sir Hans Sloane had to set him right on an herb he had misnamed.[15] The curate and naturalist, Abraham de la Pryme (1672-1704), described in 1702 how a man acquired hydrophobia from contact with the saliva of the unbit whelp of a mad bitch and exhibited all the signs of madness.[16] The famous Richard Mead (1673-1754) also sent in an account of three cases (1709).[17] He narrated the conduct of a boy who died after being bitten some five weeks earlier; a postmortem showed only a stomach reaction. The other cases were those of a man bitten by a mad dog and of another bitten by a mad fox. He concluded that the disease was an inflammation of the blood. Meanwhile Mead had published his *Mechani-*

[11] *Ibid.*, XV, 916; Abr., III, 133.

[12] *Ibid.*, XVI, 298; Abr., III, 362. Gordon (1647-1704), a Scottish scientist, inventor, and member of parliament.

[13] *Ibid.*, XVI, 408; Abr., III, 410. Mayerne (1573-1655) was born in France but after 1611 lived in England where he was a royal physician. In connection with these recipes it is pertinent to recall some samples from the fifteenth century: "For biting of a dog. Roast garlic (and) onions, of each equally much, and stamp them with honey; and make an ointment thereof, and lay on the bite, and a plaster of sodden (boiled mallows) thereupon." "Another. Make a plaster of way bread and the white of an egg, and lay thereto. And it will draw out the venom and heal the whole." "Another. Take cress and pennyroyal and seethe it in water and give him to drink. And lay of the dog's hair thereto if thou mayest have it." W. R. Dawson, *A Leechbook or Collection of Medical Recipes of the Fifteenth Century* (London, 1934), 55.

[14] *Phil. Trans.*, XVIII, 24; Abr., III, 608. Turner (1667-1741), physician and surgeon, wrote on fevers and syphilis.

[15] *Ibid.*, XX, 49; Abr., IV, 232. Sloane was, of course, the famous physician and botanist (1660-1753).

[16] *Ibid.*, XXIII, 1079; Abr., IV, 645.

[17] *Ibid.*, XXVI, 433; Abr., V, 525.

cal Account of Poisons (1702 *et al.*), and Dr. Humphrey Ridley, a distinguished clinician and theorist (1653-1708), his *Observationes Medico-Practicae et Physiologicae* (London, 1703; Leyden, 1738). The first recommended, among other remedies, ashes of the river crawfish, the sponge of the dog-rose, alyssum or madwort, and cold bathing. Ridley, supplying a full clinical account of hydrophobia, prescribed cupping and submersion.

Concern with the disease seems to have fallen off for several years after Mead's contribution to the Royal Society, but *Mist's Weekly Journal* of August 3, 1728, revived public attention by reporting the case of a man who ate the liver of the mad dog that bit him and then washed himself in the sea. Three years later Dr. John Innes published "An Inflammation of the Stomach, with Hydrophobia and other uncommon Symptoms" in the Edinburgh *Medical Essays* (I, 283). In 1735 conditions must have been unusually bad, for concern started in earnest and scarcely flagged during the remainder of the century. Dr. Robert James (1705-76), chiefly remembered for his *Medical Dictionary*, in communicating some experiments with mercury, related the antiquity of the disease and went on to say that mercury was the most effective antidote against, and cure for, hydrophobia; it had never failed on dogs or persons.[18] Stephen Hales (1677-1761), physiologist, inventor, and curate, expressed himself very sharply in a private letter.[19]

The periodicals reflected popular excitement from the outset. Two printed a contribution in 1735 declaring that salt water often failed as a cure and that the legislature should apply a remedy "however violent to

[18] *Ibid.*, XXXIX, 244; Abr., VIII, 69.

[19] *Bibliotheca Osleriana* (Oxford, 1929), No. 1084. Moreover, one should not neglect the attention given hydrophobia in Peter Shaw's *New Practice of Physic: wherein the various diseases incident to the human body are describ'd their causes assign'd, their diagnostics and prognostics enumerated, and the regimen proper in each deliver'd; with a competent number of medicines for every stage and symptom thereof. Prescrib'd after the manner of the most eminent physicians among the moderns, and particularly those of London. The whole formed on the model of Dr. Sydenham, to execute the Design of his* Processus Integri (London, 1726; 7th ed., 1753). This physician and chemist, best remembered for his translations of Boerhaave and Stahl, found hydrophobia caused by the infusion of the infected saliva into the blood. The symptoms were flying pains, melancholy, irascibility, tremors, fever, thirst, and convulsions at the sight of liquid. The danger of the bite varied with its depth and degree of taint. Cure should be started before the phobia appeared and should take the form not of frying the dog's liver but of cauterization and scarification. The victim could be bled after the phobia came on, but especially should he be submerged in salt water—"plunged deep, and kept as long there as may be without drowning." Irrespective of the efficacy of this in geniune hydrophia one cannot deny its validity as a treatment for hysterical hydrophobia.

so transcendent an evil." [20] The infection so transmuted the blood that it gave the voice of the dog to the wretch afflicted. Sustaining this contention was the case of a man who, being bitten, immediately took some of Mead's powder, bathed in salt water, and drank large quantities of the same.[21] Although he continued well for about six weeks he was always a little indisposed at the full of the moon; then the symptoms returned and he died. His being bitten in the nose " so near the principal parts might possibly prevent his being cured by Dr. Mead's Remedy, so successful in cases of this dreadful malady." This remedy, which in Mead's own experience of thirty years with more than five hundred patients had never been known to fail, should be taken as soon as possible after the bite, but it worked even after a fortnight. It prescribed bleeding nine or ten ounces, then administering a mixture of ground liverwort and black pepper in half a pint of warm milk every morning and fasting for four successive mornings. After the four doses the patient must take a cold bath every morning and fast for a month; he must be dipped all over but not stay in longer than a minute if the water was very cold; thereafter he should go in thrice weekly for a fortnight.[22]

The *London Magazine* (IV, 474) printed an essay in which was included " a Method whereby any Person, labouring under that Misfortune, may infallibly cure Himself." The anonymous author believed that the infectious foam of a mad dog was composed of " minute particles or animalcula, mixt with saliva." Insinuating themselves into the " nervous juice " these soon affected the brain. His mind increasingly and continuously irritated, the patient grew raging mad and in a short time died. This madness was entirely different from the ordinary passion which occasionally overtook man; it came from infection and had scarcely ever been known to be cured once the symptoms appeared. The chief guarantee of a sound cure was to destroy the animalcula. Wherever they remained, even though quiescent, they could propagate their species and the patient would not be safe. This explained the instances where persons seemingly cured had been carried off raging mad a short time later.

Having related his theories and set forth earlier cures the author described his own procedure.

> First, I order them to bleed, and let a poultice, immediately, of the warm blood of a sound dog, mixed with oatmeal, be applied to the wound, and repeated three

[20] *Gentleman's Magazine*, V (1735), 123; *London Magazine*, IV (1735), 116.
[21] *Gent. Mag.*, V, 386; *Lond. Mag.*, IV, 391.
[22] *Gent. Mag.*, V, 499; *Lond. Mag.*, IV, 442.

times; as also to dip in the sea, if near, or convenient for the patient, and be put to bed to sweat; otherwise, in some cold spring, which will answer the same intention as that of the sea; and to eat the dog's liver, and to feed often upon liver of any kind. If these rules are observed punctually, there is no doubt of a safe cure; but in cases more obstinate, where persons have neglected using these proper means, I recommend the magnetic powder, and sweating by a medicine applied to the urine, by which I have cured several, even after manifest symptoms of the disorder appearing upon them. P. S. There is an absolute necessity, to use all possible means whatsoever, to prevent such fatal consequences; and it seems in a great measure to depend much on lessening the number of those animals, which produce such a terrible disease; and I believe, where one is absolutely necessary, ten are useless, and in proportion to that number, such will be the mad ones: But those who are fond of keeping them for fancy, or pleasure, would do well to worm, when young, and bleed them every spring, and fall of the leaf, and give them shaving of pewter in a bit of butter, mixed with the flower of brimstone, and not suffer them to run about, as tho they were masterless.

In 1736 the Royal Society received two more reports. Whether or not Cromwell Mortimer was unconvinced by James he gave his support to Dampier's recipe.[23] Dr. Edward Nourse (1701-61) preferred cauterization, but failing this he had recommended Dampier's powder; eighteen months later his patient fell ill and died.[24] Shortly after these suggestions a Frenchman communicated an infallible cure to the *Gentleman's Magazine* (VII, 691), which called for powdered male oyster shells in a pint of white wine to be taken while fasting for three days; the victim should eat nothing oily during the cure.

The year 1738 brought several reports on hydrophobia to the Royal Society. Dr. John Fuller had always found Dampier's powder successful in curing mad dog bites.[25] The physician and philosopher, David Hartley (1705-57), and Dr. Sandys related the case of a person bitten in 1732; he had been bled, purged, and dosed after the bite but in six weeks he had become ill in the usual way. Hartley prescribed bleeding and cold bathing; the patient survived and in 1738 seemed fully recovered.[26] Thomas Steward (1669?-1753), a naturalist and divine, praised the virtues of buckshorn plantain and stressed its successful use in his locality. Mortimer had mistaken the nature of this plant, and Steward was correcting him.[27]

[23] *Phil. Trans.*, XXXIX, 313; Abr., VIII, 84. Mortimer (d. 1752) wrote variously on medicine and was much interested in animal diseases.
[24] *Ibid.*, XL, 5; Abr., VIII, 113.
[25] *Ibid.*, XL, 272; Abr., VIII, 204.
[26] *Ibid.*, XL, 274; Abr., VIII, 205.
[27] *Ibid.*, XL, 449; Ab., VIII, 269.

In the same year the *London Magazine* (VII, 45, 111) printed two items on the subject. The first reported the case of two persons who after being bitten went directly to dip in salt water. One kept his wound open and discharged the venomous infection; but the other's bite healed up, and he was to all appearances well. In a short time, however, he became ill and was soon raving mad, barking and howling and biting at everything in his way. He had sensible intervals when he begged to be tied down to prevent his doing mischief. By his own desire a surgeon opened a vein and the victim bled to death.

The second item described a sure method of preventing, and the most probable way of curing, hydrophobia, hitherto found incurable. After a person was bitten he should be bled in the neck or arm, the wound and adjacent parts rubbed with mercury ointment, and powdered liverwort and black pepper taken in wine, water, or warm milk. The unction should be repeated every evening and the powder every morning while fasting for three weeks or a month. After the patient had recruited his strength and if his surgeon thought fit, he should go into the cold bath. When through neglect or after the patient had been amused by going to the sea, eating part of the dog's liver, and taking jumbles of antidotes, the harbingers of hydrophobia—mopishness, want of sleep, horrible dreams, unusual proneness to anger, tingling numbed pains, swelling about the wounds, great heat and thirst, tremors, convulsions, delirium, and sharp pains in the stomach and throat—appeared, the surgeon must increase the unction wherewith the wounds and parts adjacent, the groin, armpits, and soles of the feet were to be well anointed, continue the powder, bleed freely, and require warm bathing. The patient might for security take *pulvis antilyssus*, yet the unction, prudently managed, would be enough. When hydrophobia appeared, the victim must be well bled and the unction rubbed into the armpits, groin, and all over the limbs twice a day in a warm room. There was no time to lose: unction was the sacred anchor, the sole hope! If a too copious salivation occurred, this must be diverted as in venereal disease by sharp clysters and blisters. Dogs might be cured in the same way as men.

In 1741 the proliferous Dr. James published his *Method of Preventing and Curing the Madness caused by the bite of a mad dog* which periodicals immediately abstracted.[28] He believed the disease to be inoculated by the bite, for the wound grew sore and festered a little before or about the time the distemper appeared. This resembled the inoculation of the small-

[28] *Lond. Mag.*, X (1741), 464; *Scots Magazine*, III (1741), 500.

pox, for the incisions where the variolous matter had been introduced became painful about the fourth or fifth day when the disease showed itself. When the inoculation had no effect, the incision healed up in a few days like a common cut. Thus James believed it possible to judge the danger of the patient by his wound. While a scab remained he was in great danger, but when the wound was once cicatrized the consequences were not threatening. He did not, to be sure, declare this a certainty but rather recommended it as worthy of observation by physicians. The symptoms of madness need no description, but he was persuaded that the barking like a dog was generally imaginary, such behavior being only in a greater degree what happened in ordinary quinsy when the parts above the larynx were inflamed and necessarily altered the tone of the voice. The first sure sign of a dog's being mad was an alteration in his bark; another certain sign, not generally known, was the great terror with which other dogs instinctively ran from a dog about to go mad.

To cure a person bitten, first rub into the wound a dram of neapolitan ointment, then give turpeth mineral by way of a vomit in a dose proportioned to the patient's age and constitution, repeated at intervals to secure it from raising a salivation, always remembering to rub the wound once a day or oftener with mercurial ointment. Meanwhile administer *pulvis antilyssus*, consisting of ash colored liverwort and pepper, recommended by Mead. Then let the patient go into cold water every morning for a month. If through neglect symptoms of approaching madness should appear, increase the mercurial ointment and give mercury internally in as large doses and as often as possible, without hazarding the patient by a salivation too precipitate. In treating the mad dog, some had objected that giving a dose of turpeth mineral was an insuperable obstacle, but James suggested fixing the dog's head so as to prevent his turning and biting, compressing the skin of the neck to make him open his mouth, and thrusting a ball fastened on the end of a thin stick or whalebone down his throat.

A few years later (1744), the Royal Society printed "A Letter from Andrew Reid, Esq. to Dr. Wilmot, concerning the effects of the Tonquinese Medicine." [29] Because this medicine—musk, cinnabar, and vermillion in a gill of arrack—was a certain cure for mad dog bite, Reid considered its value for other diseases, notably fevers. He had tried it on gaol fever victims beneficially and found it successful in convulsions and delirium.

[29] *Phil. Trans.*, XLIII, 225; Abr., IX, 89. Reid (d. 1767) was a compiler of scientific information; Sir Edward Wilmot (1693-1786) was physician to several members of the royal family.

Time and again during the next several years this remedy, or variations on it, appeared in the magazines. In 1747 the *London Magazine* (XVI, 284) printed "a genuine Indian recipe for the bite of a mad dog" which called for cinnabar and musk, powdered and well mixed, and taken in a tea cup full of arrack. This secured the patient; thirty days later the dose should be repeated. It must be taken immediately after the bite and if the patient had any symptoms of the disease the second dose must be repeated three hours after the first. The next year the *Gentleman's Magazine* (XVIII, 131) reported Dr. John Wall's success in curing mad dog bite with musk.[80] In 1750 three periodicals printed the "infallible" cure brought from Tonquin by Sir George Cobb; this was identical in content and administration with the "genuine Indian receipe." As printed the recipe was calculated for adults and should be given to children in smaller doses in proportion to their ages. The medicine had been given to hundreds with success, and Cobb himself had cured two persons already having symptoms of madness.[81]

Meanwhile other contributions had been forthcoming. Dr. Charles Peters (1695-1746) described at length for the Royal Society a case under his care, and the *London Magazine* published a complete account of his report.[82] A robust, middle-aged man, who had for some years followed the occupation of curing sick dogs, was in that capacity bit in the thumb; the next day the dog drooped, refused his food, and died. The patient, conversant with such matters, was sufficiently alarmed to go to a hospital where the physician prescribed scarifying the wound, bleeding, *pulvis antilyssus*, and a cold bath. Since fits followed attempts to eat and drink and bleeding brought no relief, the doctors decided to follow the usual cure for inflammatory fevers. They ordered an enema and a bolus; thereupon the patient enjoyed a most refreshing sleep; his blisters discharged plentifully; his mind became more composed; and his horrors were so far mitigated to permit him to swallow half a pint of ale, though not without repugnance. He still, however, complained of living in a flame; the pain in his head remained acute; and he suffered from numbness in the diseased arm, inquietude, and difficulty in swallowing and respiration. As time passed the symptoms became less violent, and his

[80] Wall (1707-76) was a distinguished Worcester physician of wide attainments in medicine—balneology, pediatrics, smallpox, and veterinary medicine.

[81] *Lond. Mag.*, XIX (1750), 56; *The Ladies Magazine: or, the Universal Entertainer*, I, 140; *The Universal Magazine*, VI, 160.

[82] *Phil. Trans.*, XLIII, 257; Abr., IX, 96; *Lond. Mag.*, XV (1745), 350; the *Gent. Mag.* (XX, 354) referred to it in 1750.

body was kept soluble with cooling laxatives. This regimen with little variation continued for two weeks, the blisters being kept open the whole time, and the distress gradually abated. The patient fell into languors which were easily removed by assafoetida and valerian. When he was free from disorders in the head and his pulse beat with a natural softness Peters advised a cold bath and *pulvis antilyssus*, but with the caution to bleed and discontinue their use whenever the patient found himself heated. The regimen was successful.

In 1747 hydrophobia received attention other than that already noted. *The Art of Cooking made Plain and Easy* included Mead's cure. The *Universal Magazine* (I, 369) printed the earlier prescriptions of Gordon and Mayerne. The year 1750 was extremely fruitful; not only did the Tonquin recipe get wide publicity but many other accounts and recipes were printed, thus suggesting that conditions must have been very bad indeed. Thomas Short, as might be expected from his interest in "waters," recommended submersion as a cure in his *Discourses on Tea, Sugar, Milk, Made-Wines, Spirits, Punch, Tobacco, &c. With plain and useful rules for gouty people.*[83] Dr. John Starr informed the Royal Society concerning his treatment of a horse bitten by a mad dog. He had first tried mercury and *pulvis antilyssus* and the horse seemingly recovered, but it soon showed signs of illness at which it was bled and given musk. Thereupon convulsions occurred and as the horse got worse it was killed.[84]

Recipes abounded and with them pleas for study of the problem. Bleeding, Mead's powder, mercurial ointment, cleansing with turpentine and vinegar, and drinking beer were industriously and unqualifiedly recommended, usually with the citation of specific cures.[85] Somewhat more thoughtfully a writer in the *Gentleman's Magazine* (XX, 317) asked that antidotes be inquired into and that persons having experience of their good or bad effects communicate the cases through the magazine. He recalled the methods most esteemed—Mead's powder, turpeth mineral, musk and cinnabar—and noted that Boerhaave and Mead had directed profuse bleeding and cooling medicines, and that the Academy of Sciences had published a cure by immersion which Boerhaave also had praised.

[83] Short (1690?-1772), a very careful student, wrote extensively on mineral waters, public health, and vital statistics.

[84] *Phil. Trans.*, XLVI, 474; Abr., X, 54. The *Scots Mag.*, XIII (1751), 478, printed a résumé of this.

[85] *Ladies Mag.*, I, 356; *Scots Mag.*, XII, 283, 414, 429; *Lond. Mag.*, XIX, 476; *Gent. Mag.*, XX, 195, 354.

The year 1751 was of a piece with 1750. Dr. Thomas Wilbraham related a case where a man bitten nine months before had apparently recovered; when he again showed signs of illness he was bled and dosed but nonetheless died.[36] Cures were freely published, of which the most interesting was the proposal that as soon as possible one should apply a cupping glass, the air within having been rarified by a flame, to the wound; by violent pressure on the flesh the blood would be expelled and with it the venomous particles. Every physician should carry several glasses and each family possess one; a cider glass, chocolate cup, pepper box, or tobacco bole *could* be used.[37]

In 1752 Brodie published *De Rabie Canina* at Edinburgh, and Dr. Richard Russell (d. 1771) declared in his *Dissertation on the Use of Sea Water in the Diseases of the Glands* (1752, 1753, 1760) that it had been "customary for those who have been bit by a mad dog, to go to be dipt in salt water; and if it be done before the patient is affected with the dread of water, it generally succeeds." The author of an "Account of several Methods of Cure" in the *Gentleman's Magazine* (XXII, 33) expressed a much more critical attitude: so many remedies had been prescribed by eminent persons with such assurance that the disease had not been regarded as a proper subject for study; neither had the discovery of other remedies been attempted. The public should know that the methods of Mead, James, and others had often failed.

Despite this warning conventional recipes were printed continually. Two in the *London Magazine* had some uniqueness.[38] One, a family cure of eighty years standing, was composed of the green rind of the elder tree simmered in strong ale; drink half a pint of the liquor morning and evening and wash the affected part with some of the liquor. The patient should be kept warm and the medicine was to be repeated every new and full of the moon for two or three times; a somewhat larger dose could be given to animals. The other remedy comprised powdered herbs which must be gathered in May, administered in new milk three mornings together while fasting, three days before the full or change of the moon.

Much more important was Nugent's *Essay on the Hydrophobia* (1753) to which periodicals gave considerable space.[39] He related the case of a

[36] *Phil. Trans.*, XLVII, 412; Abr., X, 245.

[37] *Gent. Mag.*, XXI. 115; *Univ. Mag.*, VIII, 138; *Scots Mag.*, XIII, 83.

[38] *Gent. Mag.*, XXII, 423; *Scots Mag.*, XIV, 478; *Lond. Mag.*, XXI, 375; XXII (1753), 147.

[39] *Gent. Mag.*, XXIII, 303; *Scots Mag.*, XV, 317. Christopher Nugent (d. 1775), physician at Bath and intimate of Dr. Samuel Johnson.

woman cured by opium and Cobb's powder, the latter being made into a bolus with honey; the bitten part was rubbed frequently with salad oil. Nugent reasoned that the poison operated not by circulating with the blood or animal spirits but by producing spasms upon the nerves, which were communicated from fiber to fiber until the nerves governing the most vital viscera were affected. He believed hydrophobia a species of mania for which the treatments ordinarily applied were valueless.

Such a caution by no means halted the printing of recipes which varied little from earlier ones. Native herbs, Venice treacle, mithridate, camphor, tin, the "best old pewter, scraped, rasped, or filed," ale, and wine, in varying combinations and quantities, were freely praised. Some writers preferred mercurial ointment, turpeth mineral, or *pulvis antilyssus*, some salt water bathing and drinking, others scarifying and cupping. Almost invariably an account of cures accompanied the remedies.[40] In addition the *Universal Magazine* (XIII, 220) provided its readers in 1753 with a test of whether a dog was mad or not: rub meat on the gums of a suspected dead animal and offer it to another; if the latter refused it the first dog was mad.

Two books appeared in the middle 50's—Bruce's *De Hydrophobia* (Edinburgh, 1755) and the popular sixpenny tract of Claude du Choisel, translated as *An Easy, Short and Certain Method of treating Persons bit by Mad Animals* (1756).[41] This latter, one of several French works known in England, was based on the author's experience in the East where his method had since 1749 cured over three hundred men, women, children, Indians, Portuguese, blacks, mulattoes, and Armenians, without one being afflicted with the least symptom of madness. Basically the regimen was mercury, externally and internally administered, with the addition of turpentine, rhubarb, colloquintida, gutta gamba, and honey; it should be inaugurated immediately after the bite. The victim must avoid tart or acid foods or anything hard to digest. Bathing had no other virtue than to quiet the minds of the patients.

The years around 1760, if the numerous recipes and accounts mean anything, must have been threatening indeed.[42] One writer described at

[40] *Scots Mag.*, XV (1753), 613; XVII (1755), 231, 299, 391; *Univ. Mag.*, XVI (1755), 185; *Lond. Mag.*, XXIV (1755), 33, 172, 187, 371.

[41] Choisel was apothecary to the Jesuit mission at Pondicherry; his tract was fully abstracted for the sake of mankind and the benefit of every apothecary. *Gent. Mag.*, XXVI, 567; *Lond. Mag.*, XXV, 627.

[42] *Gent. Mag.*, XXIX (1759), 401; XXX (1760), 371, 381, 547; *Scots Mag.*, XXII, 403; XXIII, 350; *Univ. Mag.*, XXVI, 200; XXVII, 100; *Lond. Mag.*, XXIX, 24, 258, 363, 590; XXX, 380; *Annual Register*, IV, 121.

length a case of spontaneous hydrophobia of which the victim died in forty-eight hours, no cause having been found. Another, declaring that internal medicines were too slow, proposed rubbing common salt slightly moistened with water well into the wound three or four times a day for a week or more and applying a compress moistened with the solution; if the wound was small it should be dilated so that enough salt might be introduced. A second cure required the application of a hot iron to the wound as soon as possible, just enough to burn the skin, then rubbing with fine oil and bandaging with yellow basilicon; the quicker the wound suppurated the better. This technique had cured over two hundred cases. The editor of the *Gentleman's Magazine* recommended one remedy because a single draught " without any bathing in salt water or other outward application " effected a perfect cure. The College of Physicians and the companies of surgeons and apothecaries should purchase the recipe, which would make it sufficiently known and preserve its reputation by concealing its simplicity from the patient.

The *London Magazine* printed three recipes from France. One of herbs, roots, and wine was so effective that no special regimen was necessary; a second explained how to discover whether a dog was mad and was identical with the method already cited; a third was a cure by mercury and the cold bath. A Lancaster doctor combined scarification, cupping, and anointing with olive oil or goose-grease; he had never lost a patient. From Berkshire came a much publicized account of a woman who, having hydrophobia and about to be smothered, sought to escape her executioners. She fell and cut her temporal artery. No effort was made to stop the free bleeding because her keepers hoped that this would solve the situation. It did so in an unexpected way, for after a time she ceased bleeding and recovered from her hydrophobia. A final fugitive notice praised pulverized pimpernel in tea.

Additional evidence of the threat appeared in the report that the dogs in London and its suburbs had to an uncommon degree been seized with madness and had bit so many other dogs as well as human beings that the magistrates had ordered all dogs to be muzzled or kept up for a certain time, and all stragglers to be destroyed; the latter had been dispatched in considerable numbers. This prompted an essay, " On the prevailing rage of dog-killing," in the *Annual Register* in which the writer ridiculed the " epidemic terror " of mad dogs and described the way rumors spread. If the truth were known, he said, only about three or four people died in a season from hydrophobia. The dog was man's best friend and did not

deserve such unkind treatment.[43] Meanwhile, James reiterated in his *Treatise on Canine Madness* (1760) what he had said before. Two years later, Daniel Layard published his *Essay on the Bite of a Mad Dog* wherein he stressed the lack of a real cure.[44]

Throughout the succeeding years the situation continued much the same. Periodicals printed innumerable accounts of cases and cures; books appeared in greater numbers than before. In 1762 the *Scots Magazine* reported the prevalence of mad dogs in Edinburgh and emphasized the need for an effectual remedy. As if in answer, the old infallible recipes were more freely published than ever. Herbs, singly or in combinations, were sure remedies; mercury, salt, turpeth, musk, cinnabar, camphor, opium, bleeding, bathing, and purges likewise had adherents.[45] The praise accorded vinegar drinking perhaps prompted the Earl of Morton, president of the Royal Society, to suggest that some persons reputedly cured of hydrophobia by that remedy had never had the disease at all.[46] As usual, odd bits of news were now and again published. A mad dog had infected cattle and horses; a boy afflicted with hydrophobia had been

[43] *Lond. Mag.*, XXIX, 434; *Ann. Reg.*, III, 127, 209. If one depended on the evidence of the London Bills of Mortality such a conclusion might be justified, for the number of deaths listed from hydrophobia was very small: one a year from 1737-42, three in 1743 and 1744, two in 1748, one in 1746 and 1747, and so on.

[44] *Univ. Mag.*, XXX, 306, 355; XXXI, 26. Layard (1721-1802), one-time physician at Middlesex Hospital, wrote variously on medicine, human and animal. The same contention was advanced by Dr. John Fothergill (1712-80) several years later. *Univ. Mag.*, LIX (1776), 197, 251. Fothergill wrote accounts of sore throat, influenza, and on the weather and disease.

[45] *Scots Mag.*, XXIV (1762), 519; XXVI (1764), 315; XXVII (1765), 398; XXVIII (1766), 502; XXIX (1767), 120, 538; XXX (1768), 528; XXXIII (1771), 254, 636, 682; XXXIV (1772), 121, 454; XXXVIII (1776), 417; XXXIX (1777), 245; XL (1778), 182, 196; *Univ. Mag.*, XXXIII (1763), 73; XXXIV (1764), 317; XXXIX (1766), 252; XLII (1768), 243; XLVII (1770), 104; LIX (1776), 197, 251; LX (1777), 34; *Lond. Mag.*, XXXIII (1764), 142; XXXVI (1767), 122; XLI (1772), 140; XLII (1773), 449; *Ann. Reg.*, VIII (1765), 126; *Hibernian Magazine*, IV (1774), 472, 527, 593; *Gent. Mag.*, XLVII (1777), 440; Joseph Dalby, *The Virtues of Cinnabar and Musk against the Bite of a Mad Dog* (1764).

[46] *Phil. Trans.*, LV (1765), 139; Abr., XII, 221. James Douglas, 14th Earl of Morton (1702-68), was a physicist and astronomer. In this connection one of the more interesting periodical contributions of the decade was a communication from a Dr. Wolf of Warsaw to Henry Baker, F. R. S., describing the cases and behavior of eleven persons bitten by a mad wolf. He emphasized the lack of success attending the use of medicines commonly reputed specifics in cases of canine madness. Bark, mercury, camphor, musk, herbs, sweating, and bleeding had all been tried but the patients died; in some instances the wounds were kept open for eighty days, scarified, and washed with vinegar. In conclusion Wolf declared that he had "formed no theory at all of this terrible disease." *Gent. Mag.*, XXXVIII (1768), 260.

smothered but the persons responsible were acquitted; worming prevented canine madness.[47]

Somewhat fuller and more critical analyses also appeared. In 1783, the *London Magazine* printed some observations on the nature and cure of hydrophobia: I. the nature of the disease; 11. disappearances observed on dissection; III. the results of experiments. The writer discussed various sedatives, specifics, and evacuants, placing the greatest reliance on sedatives and sudorifics used in conjunction with bleeding and bathing. He praised the efficacy of opium and concluded by giving his own method of cure which resembled many already related. Later in the year the same magazine abstracted John Berkenhout's *Essay on the Bite of a Mad Dog, in which the claim to Infallibility of the principal preservative Remedies against the Hydophobia is examined.* This author considered the various names for canine madness and placed hydrophobia as a species of *angina convulsiva* or *suffocativa.* He described the symptoms and ridiculed other doctors' theories on the mode of infection, their curative powders and recipes. His own treatment depended on sucking the wound and cupping to draw out the poison; when infection had occurred the only remedy was mercurial unction.[48] Such scepticism of course did not deter those contributors whose faith in cauterization, bathing, drugs, herbs, vinegar, oil, egg yolks, pewter and lead filings, treacle, fresh earth, honey, elder, snakeroot, ale, and mushrooms still remained pure.[49]

[47] Such circumstances, as well as more analytical accounts were reported not only in the general periodicals but also in professional transactions and individual pieces: Thomas Dickson, "Cases of the Bite of a Mad Dog," *Medical Observations and Inquiries,* III (1767), 356; John Fothergill, "Remarks on the Hydrophobus Internus," *Ibid.,* 319; "Fatal Case of Hydrophobia," *Ibid.,* IV (1768), 195; "Additional Remarks on the Treatment of Persons bit by mad Animals," *Ibid.,* 290; *Case of Hydrophobia* (London, 1773); [William Falconer], "A Case of Hydrophobia, successfully treated," *Medical Transactions,* II (1772), 222; Nicholas Munckley, "An Account of a Fatal Case of Hydrophobia," *Ibid.,* 46; J. Heysham (1753-1834), *De Rabie Canina* (Edinburgh, 1777); J. Vaughan, *Two Cases of the Hydrophobia; with Observations on that Disease* (2d ed., 1778). I regret that I cannot vouch for the accuracy of all these and similar citations in the notes and text inasmuch as the works themselves have not in every case been available to me. Many titles have been secured from Robert Watt, *Bibliotheca Britannica; or general Index to British and Foreign Literature* (4 vols., Edinburgh, 1824) which though enormously full is neither invariably exact nor altogether orderly.

[48] *Lond. Mag.,* LII, 162, 335. Berkenhout (1730?-1801) was a versatile physician and naturalist. See also for this period, James Johnstone (1730?-1802), "Cases of Hydrophobia," *Memoirs Medical,* I (1782), 243.

[49] *Scots Mag.,* XLVII (1785), 320; LII (1790), 330; LIII (1791), 147; LVI (1794), 96; *Hib. Mag.,* XIX (1789), 678; XXI (1791), pt. ii, 510; XXIV (1794), pt. i, 433; XXV (1795), pt. i, 126, 230; *Univ. Mag.,* LXXXVII (1790), 123; LXXXVIII (1791), 395; *European Magazine,* XX (1791), 427; XXI (1792), 157, 318, 342; *Gent. Mag.,* LXI (1791), 912, 1004.

In 1794-5 one of those little controversies that often enlivened 18th century journalism flared up.[50] A writer reported a "remarkable" case in which sea water, "the most effectual remedy," was not used and the patient died. This inspired the comment that sea bathing and bleeding alike were futile. Another contributor belittled the hydrophobia menace, only to excite the response that the disease was a most deplorable malady and that to belittle it stigmatized the writer's medical character. To this it was replied that many vulgar errors surrounded hydrophobia and that the College of Physicians did not believe the disease to be communicated by mad animals; whereupon an irate gentleman suggested that thirteen members of the college submit to the bite of mad dogs for thirteen successive months under close inspection. He had no doubts as to the result, and declared that if the victims should be unable to save themselves they should then resort to a nostrum known to laboring men.

Similarly in these years unusual circumstances were reported.[51] Some accounts obviously aroused interest if not suspicion, and correspondents would request added information, arguing that the imperfect state of knowledge warranted the fullest recording of every authenticated case. The number of books and lengthy articles steadily increased: Robert Hamilton, *Remarks on the Means of obviating the fatal effects of the bite of a mad dog* (1785, 1798); Thomas Houlston, "Observations on Canine Madness," *Medical Commentaries*, VIII, 304, and "Remarks on the Hydrophobia, and on the Efficacy of the Ormskirk Medicine, for the Bite of a Mad Dog," *Med. Com.*, XI (1786), 330; Alexander Gray, "The History of a Case of Rabies Canina, attended with singular circumstances, and terminating fatally, after a Salivation had been induced by Mercury," *Med. Com.*, XII (1787), 304; J. McIlwaine, *De Rabie Canina* (Edin., 1787); Jesse Foot, *An Essay on the Bite of a Mad Dog* (1788, 1791) and *A Plan for preventing the fatal Effects from the Bite of a Mad Dog* (1792); T. Percival, *Hints toward the Investigation of the Nature, Cause, and Cure of the Rabies Canina* (1789); James Sims, "Of the Hydrophobia, from a Greek Manuscript in the Author's Possession," *Memoirs Medical*, II (1789), 1; John Ferriar, "Case of Hydrophobia; with the appearances on dissection," *Medical Facts*, I (1791), 1; Wm. Lofric, "Some Observations on the Prevention and Treatment of Hydrophobia," *Med. Facts*, I, 11; Robert White, "Remarks on the Bite of a

[50] *Gent. Mag.*, LXIV, 598, 718, 780, 892, 994; LXV, 11, 110, 194.

[51] *Gent. Mag.*, LXV (1795), 131; LXVII (1797), 764; *Monthly Magazine*, II (1796), 916; III (1797), 8; *Hib. Mag.*, XXVII (1797), pt. i, 56; XXXIX (1799), pt. i, 258; *Scots Mag.*, LX (1798), 366; *Univ. Mag.*, CX (1802), 27, 404.

Mad Dog," *Mem. Med.*, III (1792), 608: T. Arnold, *A Case of Hydrophobia, commonly called canine madness, from the bite of a mad dog, successfully treated* (1793); James Mease, *An Essay on the Disease produced by the bite of a mad dog, or other rabid animal; with a preface, and an appendix by J. C. Lettsom* (1793); *Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge* (1793); Richard Simmons, "A Case of Hydrophobia," *Med. Facts*, V (1794), 87; Edward Barry, *A Letter on the Necessity of adopting some Measures to reduce the present Number of Dogs; with a short Account of Hydrophobia, and the most approved remedies against it* (1795); Alexander Johnston, "History of a Fatal Case of Rabies Canina," *Med. Com.*, XX (1795), 264; J. Brockenbrough, *De Rabie Canina* (Edin., 1795); Richard Pearson, *The Arguments in favour of an Inflammatory Diathesis in Hydrophobia considered; with reflections on the nature and treatment of that disease* (1798); William Gaitskell, "History of a Case of Hydrophobia," *Mem. Med.*, V (1799), 1; John Haynes, "Case of a Fatal Termination, after the Bite of a Mad Dog," *Mem. Med.*, V (1799), 289; William Norris, "Case of the Bite of a Mad Dog," *Mem. Med.*, V (1799), 302; T. Smyth, *De Rabie Canina* (Edin., 1799); *Directions to prevent Canine Madness by Ablution* (1799); and probably others not discovered.[52]

The early 19th century brought no great change. Periodicals printed descriptions and recipes which resembled those of a century past. Now and then an interesting or novel item comes to light. One writer suggested that condemned criminals be pardoned on submitting to a mad dog bite for experimental purposes. Others warned against the futile preventives on the market and called for judicious advice. Some debate arose over the value of worming dogs.[53] To such items may be added the considerable output of books, most of them comparable to what had been appearing just previously: George Lipscomb, *Cautions and Reflections on Canine Madness; with a method of preventing hydrophobia in persons who have been bitten* (1807); *Cases and Cures of the Hydrophobia, selected from "The Gentleman's Magazine"; containing many curious*

[52] Hamilton (1749-1830) was an army surgeon; Foot (1744-1826) was chiefly distinguished for his efforts to outshine John Hunter; Percival (1740-1804) wrote widely on medicine; Ferriar (1761-1815) was active in preventive medicine; Arnold (1742-1816) wrote on insanity; Barry (1759-1822) was both an M. D. and a D. D.; Pearson (1765-1836) studied the plague and influenza. The others through unknown to me seem to have been qualified doctors.

[53] *Gent. Mag.*, LXXV (1805), 38; LXXVII (1807), 346, 1150; LXXVIII (1808), 130, 235, 315; LXXX (1810), 112; LXXXV (1815), pt. ii, 40, 400; LXXXVI (1816), pt. i, 102; LXXXVII (1817), pt. ii, 17, 40, 218, 517.

and interesting accounts relative to that most alarming malady (1807); George Pinckard, *Case of Hydrophobia* (1808, 1819); Benjamin Mosely, *Hydrophobia, its Prevention and Cure; with a description of the different stages of canine madness* (1808); G. L., *History of Canine Madness and Hydrophobia; with methods of treatment, ancient and modern* (1809); Alex. Marcet, "A Case of Hydrophobia; with an account of the appearances after death," *Medico-Chirurgical Transactions*, I (1809), 132; William Marriott, *A Treatise explaining the Impossibility of the Hydrophobia being caused by the bite of a rabid animal* (1809); Michael Ward, *Facts establishing the Efficacy of Opiate Frictions in Spasmodic and Febrile Diseases; also outlines of an attempt to investigate the nature, causes, and method of cure of hydrophobia and tetanus; with cases and remarks* (1809); James Gillman, *Dissertations on the Bite of a rabid animal; being the substance of an essay, which received a prize from Royal College of Surgeons, London* (1812); J. O'Donnell, *Cases of Hydrophobia; with Observations on the Nature and Seat of the Disease* (1813); Richard Satterley, "A Case of Hydrophobia terminating fatally, with the appearances on dissection," *Medical Transactions*, IV (1813), 348; *Particulars of the Successful Treatment of a Case of Hydrophobia* (1813); Caleb H. Parry, *Cases of Tetanus and Rabies Contagiosa; or canine Hydrophobia, with remarks* (1814); Andrew Marshall, *The Morbid Anatomy of the Brain, in Mania and Hydrophobia* (1815).[54]

Of these writers the most widely known was Mosely who divided the disease into three stages: hydrophobia, or dread of water; dyscataposis, or difficulty in swallowing; and rabies, or convulsion, attended with spitting and foaming. He summarized treatments and argued that the disease could come only from the poison of an external bite and that it was disseminated from some particular dog in which it originated; he emphatically excluded "the idea of spontaneous madness, arising from some peculiar influence in the air." The injured part must be cut out, caustic and poultices applied; mercurial ointment was most effective and immediate treatment was essential. Most physicians approved such a regimen though each tended to vary the details a little.

Although this sketch stops with the dawn of the 19th century, when the achievement of Pasteur is still remote, we may discern a considerable

[54] Lipscomb (1773-1846) wrote extensively on medicine, history, and public questions; Pinckard (1768-1835) was an army physician; Marcet (1770-1822), physician and chemist; Parry (1755-1822) prepared his inaugural dissertation on rabies; Marshall (1742-1813), eminent anatomist and physiologist; Mosely (1742-1819), a wide and observant traveler, was a specialist on tropical diseases.

change in outlook during the years that have been surveyed.[88] Infallible "cures" and procedures continue to be published but alongside are at least three obvious developments: a healthy scepticism, a demand for evidence, even dubious evidence—because here was a disease so horrible, so prevalent, and so incalculable that no possibility, no piece of information could be overlooked—and increasing attention on the part of specialists. Conjecture is steadily giving way to clinical observation and experiment. Nugent realized the connection with the nervous system; James grasped the existence of hysteric "hydrophobia"; many persons demanded governmental action. These tendencies and developments, be it remarked, are not superficial.

Moreover, it may be suggested that even in the folklore there were hints, the thin edges of sound procedures, the dim light prefacing greater clarity, that led men of greater knowledge and technical equipment not to the final solution, for the morning paper discloses a rabies scare in half a dozen cities, but to the probability of a solution. When that arrives the historian will know that however far removed in appearance the successful treatment is from the "cures" and the trials and errors of two centuries past, in reality a definite chain of being connects the two.

[88] Rather interestingly I have found no allusion in the period surveyed to what seems to have been a common and "infallible" method of combatting prospective hydrophobia in various parts of Missouri, namely, the use of a "madstone." I am indebted to my colleague, Mr. William Settle, for the following excerpt from the *Richmond Democrat* for March 20, 1884: "Sedalia Democrat: T. L. Shoemaker, the young man who was bitten by a mad dog Friday, in Windsor, returned yesterday from Kansas City, where the madstone of Dr. Dixon was applied three times and stuck, but refused to stick the fourth. When the stone doesn't stick it shows there is no poison present. He says the doctor will enter into a bond of $100,000 with responsible parties that he can cure any case which is brought to him in time. In the last two years over 600 patients have been cured, it is said, by Mr. Dixon." On July 15, 1886, the *Richmond Democrat* printed a letter from an Arkansas doctor concerning the efficacy of mad-stones, and after relating several cures the author concluded: "These are all plain home facts, and facts are very stubborn things. . . . I am aware that physicians generally are prejudiced against the mad-stone, and advise people accordingly, but I am an old and retired physician, and were I bitten by a rabid animal I would take the mad-stone in preference to Mr. Pasteur or anything else I know of. Red chick-weed and also elecampane root have long been known as antidotes of dog poison." (As late as 1912 people commonly went from Richmond to Kansas City to be cured by the mad-stone.) The St. Joseph *Weekly Gazette* for August 16, 1883, reprinted an article from the *New York Sun* in which the physician author praised a drug prepared by South American Indians as *the* remedy for hydrophobia; interestingly enough, he emphasized that not more than one in a hundred victims of dog bite actually had the disease.

DENTISTRY IN THE GHETTO *

HENRIK SALAMON

Perhaps it may be of cultural interest to examine how and to what extent dentistry was practised in the past, especially from the late Middle Ages to modern times, by a people which lived severely separated amongst nations whose faith and customs differed from theirs, e. g. by the Jews in the Dispersion. Closed within the so-called ghettos and despised by the host peoples, Jewry was forced for religious and social reasons to provide for all its needs almost autarchically, thus it also provided for the treatment of physical infirmities, among which naturally tooth diseases were included too. Even if it cannot be said that medical science and its practical application developed among the ghetto Jewry completely independently from that of the Christian host peoples, yet the strict legal and social separation must have caused the growth of special features which impressed a peculiar character on the level of hygiene, as was the case with all other aspects of life.

Therefore it is justified to raise a question of cultural historical interest, which has never been coherently investigated as yet: *how did dentistry reveal itself in theory and practice among the Jews of the ghetto in the Middle Ages and later on till modern times?*

In the different European countries: in Spain, Portugal, Italy, Germany, the corresponding conditions were rather uniform. The sources at my disposal are the most comprehensive regarding the ghettos of Germany.

I. The Stock of Knowledge in the Bible and Talmud

In order to judge Ghetto-Jewry's property and achievements in dentistry, we have to consider first of all the legacy taken over from its predecessors. It is the Bible and the Talmud which give us information about this question, as Jewry has taken from these books all she needed for her psychic and physical training.

All that the older well known historical works of Sprengel,[1] Carabelli,[2]

* The Editors wish to express their gratitude to Dr. B. W. Weinberger of New York who very kindly consented to look over the proofs of this article, since it was impossible for them to be read by the author.

[1] Sprengel, *Geschichte der Chirurgie*, Halle, 1829.

[2] Carabelli, *Systematisches Handbuch der Zahnheilkunde*, Wien, 1831.

Isensee,[3] Linderer,[4] and the newer ones of Geist-Jacobi,[5] Guerini,[6] Sudhoff,[7] Haber,[8] Lufkin,[8a] etc. contain about the dentistry of the ancient Jews, refers just to this stock in the Bible and Talmud, but only quite superficially, as they do not draw from original sources. Only two German authors, Julius Preuss [9] and Gabriel Nobel [10] have written about it more extensively and on the basis of original research, and therefore it is these two authors whom we mainly follow—often literally and sometimes without special mention—when exposing the respective material.

A. *Anatomy*

Hyrtl's sentence: [11] "There was a time when anatomy was written of, although anatomy did not exist," a period which he takes from the death of Galen (201 A. D.) to Mundinus de Luziis (died 1326), may be pushed backwards and also be applied concerning the anatomy of the Bible and the Talmud, which is of a later period. Preuss even asserts that a writing of purely medical content does not exist at all from ancient Jewish times, and therefore there is no "medicine of the Talmud," no "Jewish medicine" in the sense that we speak of Egyptian or Greek medicine. But a great amount of medical knowledge is interwoven in the religious, hygienic and social prescriptions of those venerable books, and the Rabbis were in possession of a relatively exact medical and also anatomical knowledge.[12]

1. *The mouth* (peh). The mouth of the embryo is closed and looks like a barley-corn (Lv. r. XIV, 8). The mouth aperture is formed by the lips (šĕ phathajim), the upper rim of which is called the lip red (ha-odem shebe sâphâh). Metaphorically, in expressions: "A man of the lips = a braggart" (Hiob XI, 2). "Words of the lips" = idle talk (II. Reg. XVIII, 20). The oral cavity is wet by the saliva (meh ha-peh). A respective proverb: "You all have spat the same spittle" = to tell the

[3] Isensee, *Geschichte der Medizin*, Berlin, 1840.
[4] C. J. and Jos. Linderer, *Handbuch der Zahnheilkunde*, 2. Aufl., Berlin. 1842.
[5] Geist-Jacobi, *Geschichte der Zahnheilkunde*, Tübingen, 1896.
[6] Guerini, *A History of Dentistry*, Philadelphia, 1909.
[7] Sudhoff, *Geschichte der Zahnheilkunde*, Berlin, 1921.
[8] Haber, *Zur Geschichte der Zahnheilkunde*, Berlin, 1926.
[8a] Lufkin, *History of Dentistry*, Philadelphia, 1939.
[9] Preuss, *Biblisch-talmudische Medizin*, Berlin, 1921.
[10] Nobel, *Zahnheilkunde u. Grenzgebiete in Bibel u. Talmud*, Leipzig, 1930.
[11] Hyrtl, *Das Arabische u. Hebräische in d. Anatomie*, Wien, 1879.
[12] Sam. Krauss, *Talmudische Archäologie*, Leipzig, 1910.

same (Sabb. 99 b). The tongue (lâshôn): all the members of the human body are erect, only the tongue is lying, surrounded by two walls, one of bones (the jaws), and the other of flesh. Proverb: "The tongue is but a small part of the body and yet it does great things" (Jac. III, 5). The salivary glands or "fountains" (Niddah 55 b) have their place in the oral cavity (Ab. R. N. XXXI) and below the tongue (Lev. R. XVI).[18] The palate "chêk," in plural "chanukajim," because the bottom of the mouth was taken for a lower palate.

2. *The teeth.* Beautiful teeth formed a part of ideal beauty and therefore teeth were cared for accordingly. The appreciation of the teeth is reflected very expressively by numerous proverbs: "Thy teeth are like a group of sheep mounting from the bath" (Cant. IV, 2; VI, 6). "Teeth whiter than milk" (Gen. XLIX, 12). "If a Narashean kisses you, count your teeth" (Chullin, CXXVII a). "The fathers have eaten unripe grapes and the children's teeth grow blunt" (Jer. XXXI, 29; Ez. XVIII, 2). "He who whitens the teeth of his neighbour is better than he who gives him milk to drink" (Kethub. CXI b. g. E. 6). "Her (the gravid woman's) body reaches between her teeth (Kethub. 16 a; "harej krejssoh bejn shinneco"). "God breaks the teeth of the wicked" (Ps. III, 8). *Nomenclature*: The tooth in general is called *shen*, especially also for the incisors (plural shinnajim); molars: *kakkê*; milk tooth *shen de-chalab*; shaky, decayed tooth *shen meara*, carious tooth *shen rô'ah*, in the canon for canine tooth *chelaviim* or *metalchoth* (Hyrtl). Regarding dental roots we also find some hints in the Bible and Talmud: "The molars, twin teeth, as they have a double root and seem to be composed of two teeth" (Tifereth Israel, Ar. Koh. hatiaumeth, Mishnah commentary by Cohn, Bechor. VI, p. 265). As to the knowledge of the pulp cavity nothing can be found, all that Nobel writes about it (ass jaw with a molar split by God, out of which flows water, etc.) is a fantastic hypothesis. It is probable that the Talmud imagined the tooth as a compact bone formation, without any internal soft parts (pulp), and therefore the touching of a dead man's tooth (just as the touching of his hair) did not render one ritually unclean. In the knowledge of a soft tissue within its interior the tooth of the dead, too, should have had the character of the impurity of dead flesh. Instead of this supposition the Talmud (B. Bathra 116 a, and Berachot 56) gives another cause for the exceptional position of the teeth as regards purity: R. Johanan had ten sons who all died. He consoled the mourners with the words "*den garme de assiraah bir*," here is a

[18] *The Jewish Encyclopedia*, New York and London 1906. Funk and Wagnalls Co.

bone of my tenth son, my grief is greater than yours, yet it must be borne. *Commentary*: How could so holy a man as R. Johanan have the bone of a dead man with him, which made him constantly unclean? Rashi: This bone was a tooth and everything on the dead is unclean, except the teeth, the hair and the nails (Oholoth III, 7, 3). Bartenoru [14] in his super-commentary upon Rashi's Pentateuch commentary ("*Amar Naki*"), based on Talmud Babli Niddah 55 a. gives the following further explanation: Everything makes one unclean that was born at the same time as the man and the root of which does not change, except the teeth, although their roots do not change, but which were not born with the man,[15] and except the hair and nails, which are born with him, but the roots of which change. A further statement about the importance of the teeth: A priest whose teeth are wanting, is unable to perform temple service, because of his bad appearance (Bek. VII, 4, 44 a); according to Preuss in the text there is the word "nâsherû" — are fallen out; in a variant there is: "nittelû" — were taken out (namely the teeth).

The question of where the ancient Jews derived their anatomical knowledge about the structure of the human body should be briefly mentioned. After Preuss: 1) from the observation of the outer form of the body; 2) from experiences in the slaughter-house, in the kitchen and on the altar of sacrifice; [16] 3) from findings on remains of human corpses (in the desert, in the water); 4) from dissections of corpses, but this is a very much debated question, connected with the ritually forbidden pollution by touching a corpse, etc.

B. *Physiology*

The physiological tasks of the mouth generally are:

1. *Chewing*. "Bite with the teeth, you find it in the feet" (R. Meïr: Sabb. 152 a), that is: well chewed is half digested. "The lips press on each other at the deep tone of grinding, the chew of him whose teeth are wanting, has not the high tone of him who chews with the teeth" (Kohelet XII, 4, bishfal kol hatachanah). "Still will stand the mills" (Sabb. 152 a, dependence on Koh. XII, 3), i. e. the teeth, as chewing organs. "The mill-maidens rest in old age, because their number is

[14] *Bartenoro*, or *Bertinoro Obadiah Ben Abraham*, celebrated rabbi and commentator on the Mishnah; lived in the second half of the fifteenth century in Italy; died in Jerusalem about 1500.

[15] In this cunning commentary the anatomical knowledge about the root development of the human teeth is hidden.

[16] Talmudists warn expressly of transferring experiences on animals to man (Tosef. Chull. 42 b; Zeb. 116 a).

decreased" (Koh. XII, 3). Speaking during the meals was prohibited in order to be able to chew better with closed mouth (Taan. 5 b).

2. *Breathing.* "The wicked withdraw from the breath of God's mouth" (Hiob XV, 30). 3. *Yawning.* 4. *Speaking.* "Let the words of my tongue be pleasant to you, O Lord, my Support and Saviour" (Ps. XIX, 15). "The kidneys advise, the heart understands, the tongue articulates and the mouth accomplishes" (*haloshann chauteich wehapeh gaumer*, Ber. 61 a.) 5. *Kissing.* After the Midrash all kissing is immoral (Gen. r. LXX, 12), except at parting, meeting and promotion.

To the physiology of speech: the remark of Rashi to Nahum III, 18: "*nofaushu kmau nofauzu*" — all the letters originating from the same source of sound may change for each other, touches the modern linguistic notion of the change of sound (consonants, vowels) in sound formation. The sounds *s*, *ss*, *sh*, *z* are formed by the end (the tip) of the tongue and the "margins" (cutting edges) of the teeth, which is a fine observation.

The single organs of the mouth are:

1. *The tongue*: Speech formation and taste. The movable part (that is mainly the tip) is the speaking part. "Glory and shame are lying in the speech and the tongue of a man is his ruin" (Sir. V. 13). The prayer *Mar-bereh-de-rabina*: [106] "My Lord, guard my tongue from vulgar talk and my lips from falsehood" is still repeated three times daily by religious Jews.

2. *The palate*: organ of taste. "The fruit of the beloved is sweet to the palate of her sweetheart" (Cant. II. 3). "The palate tastes everything, distinguishes sweet from bitter, and so do the jaw and the tongue" (Zohar III, 294 u).

3. *The teeth.* Hard formations ('Ab. z. XXVIII a), for biting and chewing. "God makes my teeth to grind themselves on pebble" (Jeremiah, Thren. III, 16). "A race with teeth like swords and with bites like knives" (Prov. XXX, 14). The complete set of teeth is a fundamental condition of human fitness and vigour, therefore Jonathan translates the passage in the Bible about the aged 120 year-old Moses: "His humours did not disappear" (*Targum lau nosh lechau*) by: The teeth of his jaw were not gone (Dt. XXXIV, 7). The importance of the teeth for chewing is so striking that the Talmud speaks, e. g. of the partial vendibility of a slave, in consequence of injury by the owner (Kidd. 24

[106] *Rabina II.* (B. Huna), Babylonian amora of the seventh generation; died in 500. His death marks the close of the amoraic period and of the completion of the Talmud redaction.

b s Ra. botel hashen mililaush). The completeness of the set of teeth is also appreciated, for in the case of gaps the teeth do not support each other any longer (Kohel. XII, 3).

Preuss briefly hints at the possibility of a *third dentition*: To the R. Chaggaj the miracle occurred that the teeth grew again to him, in spite of his age of 80 years, as a reward for his extraordinary endeavour at the burial of R. Huna (j. Kil. IX, 32 c 9). To this Nobel remarks: This way of reading is based on an error. There does not stand "*shinov*" — his teeth in the text, but "*shonov*" — his years. Thus the reward of R. Chaggai consisted of the doubling of his years and this blessing comprised the other one, namely the growth of his teeth as well.

C. *Pathology*

The question arises concerning what the ancients knew about:

1. *Dental diseases* and particularly about the *caries of the teeth*. They knew very little about the latter. There is no clear mention of a carious tooth (shen rô'ah) in the Bible and Talmud. Only indirect statements about decaying and black teeth are at our disposal. Also a red tooth is mentioned by the commentators (Maimonides and Nahman to Sabb. 64) which seems to be explained by an inner bleeding in the tooth, caused by a trauma: a hit or a fall on the tooth. The proverb: "It is but a decayed tooth or a shaky foot to trust the faithless in the day of need" (Prov. XXV, 19: Targ. bishthah — bad) means that a faithless person cannot be more relied upon than a decayed tooth (or a shaky foot) and in this way the value of both is very descriptively estimated. All that Nobel states concerning the aetiology of dental diseases (about a vermin theory) is nothing but vague supposition, and in this respect everything that some lexicographers (e. g. Levy and Krauss, l. c.) and commentators write on operative treatment (gold filling!) in the Talmud is to be discarded. No mention can be made of it in connection with those times. The lack of distinction of the individual dental diseases is compensated by an extremely rich materia medica for toothaches, as will be seen in the next chapter.

2. *Mouth diseases*. The mouth is healthy when it does not smell. Therefore the *foetor ex ore* (reach hapeh) is the first sign of all mouth diseases. It is often the consequence of obstipation or digestive disturbances, not infrequently also of nasal polypus (Ket. 77). Its great hygienic and social importance is demonstrated by the circumstance that if someone

married a women on condition that she was free of physical faults and later on she proved to be affected with foetor ex ore, the marriage was not valid (Keth. 75 a). To the aetiology of this troublesome evil: long fasting (Abot R. N. VI, 3; Gn. r. XXXXII, 1.); according to R. Johanan the daily taking of lentils (Ber. 40 a); after R. Jizhak: if one eats raw cabbage before the fourth hour in the morning (Ber. 44 b); if one eats in the evening and does not walk four cubits at least before going to bed, as otherwise the food rots in the stomach.

A strange mouth and tooth disease is mentioned in the Talmud with the name *câphdînâh* from which R. Johanan [17] and Rabbi [18] suffered. To the aetiology: Eating of very cold wheat dishes, of very hot barley mash or of small fish fried with flour in their own oil.[19] To the anamnesis: Rabbi earlier suffered six years long from stone in the bladder, he was of a weak constitution. To the symptomatology: if he touched something with his molars, suddenly there came blood from his gum, the teeth were sensitive. The disease is dangerous, begins in the mouth and finishes in the bowels. Alveolar pyorrhoea, stomatitis and a scorbutic disease may be thought of. It should be considered that in ancient times forms of such maladies existed which are unknown today. Nothing definite can be said, in consequence of the few data. According to a version (j. Sabb. XIV, 14 d 30) Rabbi Johanan was healed by a secret remedy of a Roman woman. He spoke of this remedy in his Sabbath lecture, *pirquâ* (j. Ab. z. II, 40 d 35), without the consent of the inventress, for which reason the Roman woman committed suicide because of the offence. After another version (j. 'Ab. z. II, 40 d 31) he got it "from the *thimtinis* (assessor of taxes?) at Tiberias" where R. Johanan lived. To the gum haemorrhage: Shulhan 'Aruk, Chapter XLVI, Paragraph 3: If one bites on bread or something else, and blood flows upon the bread from the teeth, the bloody

[17] Johanan B. Nappahah, born at Sipphoris, died at Tiberias 279, generally cited as "Johanan." His acquaintance with Rabbi was only slight, although he attended his lectures for a short time. He is the subject of many legends (Ber. 5 b; Yer. Ber. V, 9 a; Hag., 15 b; etc.).

[18] Rabbi Jehudah, redactor of the Mishnah (135-220). He was the first of Hillel's successors to whose name the title of hereditary dignity, "ha-Nasi" (the prince), was added. In traditional literature he is usually called Judah ha-Nasi, in the Mishnah always simply "Rabbi."

[19] A egendary aetiology to Rabbi's case: A calf ran away from the butcher, fled under Rabbi's cloak and asked: Rabbi, save me! But he replied: Go away, for thou hast been created to this end! Therefore he suffered from câphdinâh, seven years long. But once when his housemaid wanted to kill a young weasel and he forbade it with the motivation: God's mercy (extends itself) on all His creatures (Ps. 145, 9), his pains ceased (B. mec. 85 a).

part must be cut off and thrown away. Blood between the teeth may be sucked up on weekdays, but not on Sabbath. Chapter LXXX: It is forbidden to press out blood on Sabbath, even from between the teeth it must not be sucked out.

3. *Trismus* has been regarded as a dangerous illness since the days of Hippocrates. Maimonides counts it among the harmless ones (Hilk. Sabb. II, 10).

4. *Tartar.* The Talmud knows the boring of a tooth *chathar* (b. B.K. 26 b) to which the commentators remark: "to prick and scratch around the tooth, perhaps in order to remove tartar."

5. *Anomalies.* R. Kahanah had a cleft lip (hare-lip), which gave the face a mocking expression, for which reason the aged and shortsighted R. Johanan thought that he was laughing at him (B. quam. 117 a). Nobel believes that he refutes this supposition of Preuss, by referring to a remark of *Rashi* to this passage, according to which Kahanah's lip was cleft in consequence of a wound, and thus he did not suffer from a developmental defect. The Talmud often refers to the *big tooth.* No further information about it can be found. Yet it might not have occurred rarely, for in the case of the doubtful widow ("Agunah," see later), it was not considered as a sign of recognition of the deceased. To the chapter: *Speech troubles* the passage: Moses was a man of heavy tongue (Ex. IV, 10), that is to say: he had not the fluency of speech, the gift of voluble eloquence. As its cause the legend tells of a burn of the tongue in childhood. A priest whose upper jaw (lechêh) projects beyond the lower one or vice versa (Bechor. M. VII, 5), is unable to perform temple service, for he looks ugly (prognathism).

6. *Occupational diseases*: Cultivation of flax and spinning was widespread in Palestine. It was mostly the men who were thus occupied. But a man may not force his wife to spin flax, because this work renders the lips split and the mouth evil-smelling (T. Keth. V, 4).

Reviewing this pathology, it may be called *popular pathology,* in the same sense as we speak of *popular medicine — popular therapeutics.*

D. *Therapeutics*

Generally all therapeutics is popular medicine, i. e. empirical. The number of remedies, taken from the vegetable, animal and mineral kingdom, and employed for the healing of mouth and tooth diseases are almost untraceable. Toothache was feared very much, so that the sanctity of

the Sabbath could be sacrificed to still it, just as in the case of internal diseases (Sulh. 'Aruk XLII, 4), i. e. it was permitted to take remedies or to do manipulations otherwise forbidden on the Sabbath (Ab. z. 28 a). Thus it becomes clear when in the Agadah the special grace is conferred on the patriarch R. Jehudah that the prophet Elijah appears to him and liberates him from his pains by putting his fingers upon the tooth (j. Keth. XII, 35 a 51).

The following list contains some of the most frequently used medicaments:

Wine: astringent effect on gum wounds. *Vinegar*: also an astringent, harmful to intact teeth (Prov. 10, 26), wholesome for bad teeth (j. Sabb. VI, 1 and 8 c 17). The Gemarah says: if there is a wound (on the tooth or gum), vinegar is wholesome, but if there is no wound then it is harmful. The same opinion is expressed by the Talmud Jerus.: it is good for bad, and bad for good ones (Sabb. 111 a), while sour *fruit juice* is useful for toothaches and of no harm to sound teeth (j. Sabb. XIV, 14 c 76); Shulhan 'Aruk Chapt. CXI, 3: If someone suffers from toothache, but has no greater pains at the moment, he must not rinse with vinegar or some other liquid in such a way as to spit it out, but he shall swallow it after the rinsing or sop bread in it and eat it. *Honey*, the sugar of ancient times, one of the most preferred means, spread on aching wounds. To characterize its general importance and popularity, and at the same time as a proof of the high esteem of the mediaeval German Jews for teaching, the following passage may be quoted: " The words of the alphabet are read to the child forwards and backwards, then the letters are spread with honey in order that the pupil should taste the sweet parts with his tongue. On a cake prepared of fine flour, honey, milk and oil, verses from Ezekhiel III, 3, on the shell of a boiled egg four other verses were written. The inscriptions on the cake and on the egg were read by the boys and then they were given to the group of pupils to eat." [20] *Spices*: Pepper, cinnamon (Uka. I, 2), nutmeg, ginger (Jome 81 b, Bar. 40 a), mastic as a means for chewing in case of *foetor ex ore* (Sabb. VI, 5. fol. 65 a). *Garlic*: wide-spread remedy in the whole Orient for all kinds of pains. Gitt 69 a brings the strange garlic preparation of Rabba Bar R. Huna: a clove of a garlic should be rubbed with oil and salt and put upon the nail of the thumb of the aching side, and surrounded by an enclosure of dough in order to protect the flesh. Nobel considers this passage as very difficult from a linguistic point of view, and as a very late interpolation, dating

[20] Berliner, *Aus dem inneren Leben der deutschen Juden im Mittelalter*, Berlin, 1871.

perhaps from the sixth century. According to another place in the Talmud (Ber. 44 b): garlic is very harmful to teeth. *Onion* promotes salivation (Jeb. 106 a). *Salt*: much recommended for foetor ex ore (Ber. 40 a). A little ball was put below the tongue and a woman was allowed to walk out with it on the Sabbath. Salt was very popular among the ancient peoples as a remedy for tooth-decay. Pliny writes: "ajunt dentes non erodi nec putrescere, si quis cotidie mane jejunus salem contineat sub lingua donec liquescat." In Sabb. 65 a: For the dental row "(ledôr shinne) a ball of salt." To the remedies with which a woman was allowed to walk out on the Sabbath belonged also—according to the same passage—the *Eruca sativa* (hedge-mustard), instead of pepper for evil smell of the mouth and scurvy-like dental diseases. *Mustard-seed* is good for every illness, but only taken once a month, as taught by R. Johanan. *Date-stones* burnt to ashes as a powder or mixed with oil and salt, spread over the gum, or half-burnt date-stones, barley-husk and dry excrements of a child, rubbed together (j. Sabb. II, 4, 152) for gum diseases. (R. Johanan's and R. Jehudah's illness). Abbaj, properly Nahmani (280-338) the most prominent representative of Talmudic popular medicine, suffered from a similar disease. He had tried everything on himself, without finding relief, until he was advised by an Ismaelite to take grains of unripe *olives*, to burn them on a new shovel and to rub the gum with them. This helped. *Goose-grease*: spread over the gum by means of a goose-feather. *Milt*: good for the teeth, but bad for the bowels (Ber. 44 b), therefore the instruction: chew well and then spit out. A powder mentioned by the name: "*sam jabeš*" (Sabb. 21, 24) with which teeth are rubbed. More detailed information about it is nowhere mentioned. *Olive oil*: as an ingredient for ointments or pain-stilling medicaments.

E. *Extraction of the teeth*

The extraction—ultima ratio of all unsuccessful dental treatment—was one of the most dreaded operations of the peoples of ancient times. And rightly so. This forcible pulling out of a part of the living body by means of absolutely inappropriate tools (these clumsy forceps do not deserve the name of instrument) is one of the roughest interventions which can be imagined. It would be the same today, in spite of forceps well constructed according to anatomical conditions, if we did not possess sovereign means of anaesthesia. Ancient Jews were also not exempt from this horror, of which we have several proofs in the Bible and Talmud. For instance:

Rab[21] warns his son Chijah: Do not allow one of your teeth to be extracted! to which the commentator R. Chananel remarks: If a canine of yours is aching, do not extract it, or else your eyes might suffer from it (Pes. 113 a). Ture Zahab[22] warns of the extraction of the teeth because of the danger to life connected with it[23] and speaks of the case that if a Jew has so violent a toothache on Sabbath that he cannot bear it any longer ("it torments all his body"), he is allowed to have his tooth extracted by a non-Jew, but only on condition that he is to open his mouth voluntarily, in order that the "uman" may extract it (Or. Chajim 328). This emphasis on the voluntary opening of the mouth on the Sabbath permits the supposition that if he has not done so on a working day, his mouth had been opened by force with the aid of some kind of a gag ("Kalbus"). The preparations for extraction required that the gum around the respective tooth be scraped off with a knife of bone or iron, then the tooth had to be worked until it became loose. For performing the extraction a forceps ("zewes") was used which belonged to the permanent inventory of a physician.[24] Rinsing with wine was probably done to check bleeding. Nothing is said in the Holy Scriptures about additional treatment, evil accidents or checking the bleeding after tooth-extractions, but if one considers that a leading motive of the surgery of those times was: *not to touch wounds, for the hand causes inflammation* ('Ab. z. 28 b), then it may be supposed that this was taken into consideration with extraction wounds as well; in the given case some other contemporary surgical measures were used also, such as "*mokh*" (lint) or a small sponge put upon the wound, or shells of garlic and onion.

F. *The tooth in the law*

One thinks at once of the ill-famed right of retaliation (ius talionis): Eye for an eye, a tooth for a tooth (Ex. XXI, 24; Lv. XXIV, 20). This is no Jewish specialty, Hammurabi knew it already, and so did Solon's

[21] Rab Ashi, a celebrated Babylonian amora, born 352, died 427, reestablished the academy at Sura, and was the first editor of the Babylonian Talmud.

[22] Ture Zahab, abbreviated Taz, the law-explaining work of the Polish R. David B. Samuel Ha-Levi, born 1586, died in Lemberg 1667. The work was first published as an annex to the part Jore De'ah of the Shulhan 'Aruk in Lublin, 1646.

[23] The anonymous author of the "Zene-Artznei (1530) writes in Chapter XII on extraction: "Diss aber sall nicht gescheen ween der schmerze am grössten ist auff das nicht omechtigkeit als mir do ich nach ein klein knabe vonn acht oder newn Jar war bey Meister Lorentz hye tzur Mitweyde geschach oder auch tzu weylen der in thodt nachfolge. . . ."

[24] Krauss, *Talmudische Archäologie.*

legislation. The law is likely to have never been applied in the literal sense, but only metaphorically, in a conferred sense, i. e. for bodily injuries—except the case of murder—a fine was to be paid to the injured, according to the Talmudic tradition. The same standpoint is to be applied to all other passages which are connected with the ius talionis, such as: "The unwashed hand that touches the mouth in the morning shall be hewn off" (jad l'peh tikozez, jad leajin tikozez, Sabb. 108 b). "And if he smite out his manservant's tooth, or his maidservant's tooth; he shall let him go free for his tooth's sake." (Ex. XXI, 27). The same is valid if the tooth had been loose, but still fit for use, and also for the case if the tooth has not fallen out in consequence of the hit, but became loose and unfit for use (T. Bq. IX, 27), yet not so, if the milk-tooth of a child slave was concerned (Mekiltha Mishn. par. 9, pg. 85 b). Also the physician who treated his slave's tooth, which he was to "bore," and caused it to fall out, had to give this slave his freedom (Bq. 26 b). In recognizing corpses teeth also play an important role, of which more will be said later. If someone spits on the ground and some other man slips on it, the former one is responsible (Bq. 3 b).

G. *Care of the mouth and teeth*

Care of the body by means of ablutions plays an important role in the Orient, therefore also particularly the care of the mouth and teeth. All this has been proved by the topics dealt with earlier: the appreciation of the teeth in a hygienic respect and as a condition of ideal beauty, their application in proverbs, their persistent treatment with the most different means, are evidences of it. Mouth-rinsing in the mornings (Or. Chajj. IV, 8), before and after the meals, was widely practised. The toothpick also belongs to the care of the mouth and teeth. Nobel gives too much importance to this question in his study. Toothpick is designated by two names, once it is "*ecem*," another time "*quesem*," in German translation "der Span" (the chip). That is was used in Biblical and widespread in Talmudic times, is proved by several facts. The most important of these is connected with the ritual bath of Jewesses (see later), and their immersing in it, when everything had to be removed from the body, and also from the oral cavity, that could have separated the water from the body. To this end a minute cleaning also of the teeth was prescribed, especially from meat residues between the teeth, for which naturally a toothpick was needed. As its material wood (of mastic, of lentisculus etc.), fish-bone, bone-splinters, gold and silver came into consideration;

only the application of reed is warned against, as it splinters and might easily harm the gum. Much disputed is the sentence of the Tosefta[25] (Sabb. V, 1): "It is permitted to walk out with the chip in the teeth" on the Sabbath. The supposition of Nobel and Preuss in this respect, about some tooth-regulating (orthodontic) purpose, is quite hypothetic and most likely unfounded. It is not even sure whether "*quesem*" always means "toothpick." Sudhoff, for instance, considers the thing as a tooth-sweeping device in the form of a small stick of wood, ravelled out on one end, which is widespread in the Orient (the "siwak" of the Mohammedans). In my opinion, the respective passage in the Tosefta does not mean the broken part of a toothpick, but an artificial tooth cut of wood (about this see later). The general popularity of the toothpick is proved by a passage in the Talmud Jerus.: R. Simon bar Kahani said to R. Simon who supported him when passing by a vineyard: Fetch me a chip (quesem) to pick my teeth with, and R. Chaggai once spoke similarly to R. Seira who accompanied him. But both corrected themselves directly and revoked their request, for if everyone would break a chip for himself, then in the first case the fence of the vineyard, and in the second the wood of the load-carrier would come to a greater damage. Another interesting passage from the already quoted book of Berliner: "Everything that came in connection with teaching was regarded as sacred (by the Israelites), therefore the small bits of wood which the letters of the alphabet were shown with, should not be used for profane purposes, e. g. as toothpicks." In the Kizur Shulhan 'Aruk (Ganzfried), Chapt. LXXX (Prohibition of work on the Sabbath), Paragraph 59: It is strictly prohibited to break or cut anything, except what belongs to eating, therefore it is also permissible to cut a straw or a chip of wood in order to pick one's tooth; it is permissible to break and rub the branch of a spice-herb in order to enjoy its fragrance, but not for the purpose of using it as a toothpick. In Chapter CLXXVII (Prohibition of all theft and robbing), Paragraph 2: It is permissible to take a trifle for which no one cares, e. g. to break a chip from a bundle of wood, in order to pick one's tooth, although pious people avoid even this.

H. *Artificial teeth*

The restoration of the lost natural teeth was generally widespread among the Hebrews in Biblical, and even more in Talmudic times. But

[25] *Tosefta* (extensions, additions), name of a collection of baraitot which treat in a more complete form than does the Mishnah the subject of traditional law. Attributed to Hiyya bar Aŭba. Appeared first as an addendum to *Isaac Alfasi's* "Halakot," Venice, 1521. *The Jewish Encyclopedia.*

only concerning the *front* teeth, because in those times the prosthesis served only for *cosmetic purposes*, and therefore the Talmudic writings do not mention it for men, for whom all kinds of showiness and jewelry were prohibited, and only mention it in the chapter: Female pomp and jewelry (Or. chajj. cap. 303). The artificial tooth is called *shen thôthêbeth*, "inserted tooth" and could always be removed by the woman who wore it, which had some ritual consequences, as will be learned later. Regarding prosthesis, the most instructive passage of the Talmud is Nedarim 66 b.: "A man had vowed not to marry his sister's daughter. She was led to R. Ishmael [26] who beautified her and then asked the youth: Was it this woman whom you renounced by an oath? The young man replied: No, then R. Ishmael released him from his oath. R. Ishmael then said with tears: "Israel's daughters are beautiful, only poverty makes them ugly." Explanation of the Gemarah: We learned that she had an inserted tooth and R. Ishmael "*assa*" — made her a golden tooth from his own. And now the important question arises: Did R. Ishmael make the toooth himself, was he initiated in this art? Or did he order the golden tooth from a craftsman ("naggar") at his own expense? Let us see the commentators to this passage. Rashi: she had an inserted tooth, *shen tôthêbeth*, one of her teeth fell out, which had been replaced by another, this latter projected in an ugly manner, R. Ishmael made her a golden one at his own cost, this is the meaning of the expression that he had beautified her. Ran (Nahmanides): [27] One of her teeth fell out and he reinserted another one. Rosh: [28] One of her teeth had broken out and in its place R. Ishmael [had] made a golden tooth to insert. My friend, the learned Chief Rabbi Dr. Leo Singer (Várpalota, Hungary) writes to me with regard to these commentators: "assa" — made, may mean after Rashi that he made it himself, after Ran and Rosh: he caused it to be made by someone else, for the words: "at his own cost" hints at it. As materials for artificial teeth: wood (Quor. h. to j. Sabb. VI, 8 c 14), human teeth, animal teeth, silver and gold (Sabb. VI, 5 65 a) were used. The Talmud says nothing about the attachment of the artificial teeth in the mouth. But the easy

[26] Ishmael B. Elisha, 70-140, contemporary of R. Akiba, was a descendant of a wealthy priestly family in Upper Galilee, particularly fatherly to poor and plain maidens, whom he clothed attractively and provided with means, so that they might obtain husbands.

[27] Ran = Nissim B. Reuben Gerondi, physician, astronomer and halachist, flourished about 1320-1380 at Barcelona; recognized as a rabbinical authority, even beyond Spain; his *Responsa* first published at Rome, 1546.

[28] Rosh = Asher Ben Jehiel, born in Germany about 1250, died in Toledo, 1328; the most prominent disciple of Meir b. Baruch of Rothenburg, representing the rigorous school which was averse to lenient decisions in legal matters.

removability of the inserted tooth led—because of some special causes which we shall return to later, and in spite of the fact that women were allowed to walk out with certain jewels on the Sabbath (Sefer haterum 240; Or sarua II, 39, Piske Recanate 91)—to the prohibition of walking out with a golden tooth on the Sabbath (Sabb. 64).

I. *The profession*

Reviewing ancient Israel's various technical and operative dental achievements, finally a most important question arises: which profession was trusted with executing this work in practice? Was it the physicians (" rôphê," " âsjâ "), the learned professional medical men whose task it was to execute also operative and technical dentistry, or were there specialists for tooth and mouth diseases, so-called " dentists " or surgeons of lower rank who did not belong to the class of the " rôphê "-s, and special craftsmen (" naggar "), so-called " dental mechanics " for the technical work? Or finally, did this kind of healing form a part of the priest's, the rabbi's duties? [29] First of all, in order to dispense with this latter possibility, it should be established that among the ancient Hebrews, unlike other primitive nations, the priests did not monopolize the art and science of healing. The Bible does not mention a single instance of a priest having performed the functions of a physician. The priests decided only with regard to some diseases whether the afflicted person was clean or unclean from a religious point of view. The Prophets, however, occasionally practised the art of healing. Elijah brought to life a child apparently dead (I. Kings XVII, 17-22); and his disciple Elisha performed a similar miraculous cure (II. Kings IV, 18-20, 34-35). Isaiah cured King Hezekiah of an inflammation by applying a plaster made of figs (II. Kings XX, 7). The rabbis possessed considerable medical knowledge, without employing it professionally. Where they had to give an opinion in medical matters, they always called physicians as experts. Although in Biblical times the Jewish physician was regarded as a scholar (" chakim "), yet he was no specialist, but a universal doctor, i. e. he helped in all diseases, also in those of the teeth. That they studied their matter thoroughly, may be concluded by the passage j. Sabb. VI, 8 c 17: R. Jassa asked R. Josse,[30] the physician of R. Jakob bar Acha: what is

[29] The Jewish physicians were usually general practitioners, very often combining the offices of rabbi and physician. *The Jewish Encyclopedia.*

[30] R. Jassa = R. Ashi (in Aramaic popularly R. Josse) is most probably one and the same person. Information of Dr. Leo Singer.

wrong with the teeth of our friend R. Jakob (who had the toothache and for whom his physician prepared a remedy on the Sabbath?) Commentary: R. Jassa and R. Ami:[81] the one had the toothache and his companion advised him (to walk out with an inserted tooth); the other had an ache in his ear and his companion advised him (to walk out with cotton wool in his ear), but we do not know who said the one and who the other. But from the fact that it was R. Jassa who asked R. Jakob bar Acha's doctor first, concerning what had happened to R. Jakob's teeth, we may conclude that R. Jassa's advice to his companion concerned dental treatment.

No trace of specialists may be found in the Talmud, not even a special profession of surgeons may be ascertained without some doubt, although Isaiah mentions especially a surgeon or wound-dresser (Isa. III, 7). The teaching was mainly done from master to pupil, from father to son. Concerning dentistry another special professional question arises: who made artificial teeth? The craftsman ("naggar"), the turner cut them of wood and bones, the goldsmith prepared them of gold and silver. On the relation between the physician, the technician and the patient not even a supposition may be formed. Finally a secondary question: who prepared the medicaments? Most probably the physician himself. In the majority of cases they came from the vegetable kingdom. The single drugs were used in water solutions or in wine infusions, applied as fumigations and fomentations, pressed into the hollow tooth by means of a wooden chip, and finally pulverized in mixtures or spread over the gum or cheek in the form of ointments, in the case of mouth abscesses blown in with the aid of a straw (Gitt. 69 a; cf. Joma VIII, b.).

Karl Sudhoff, the celebrated German medical historian, writes in his *Geschichte der Zahnheilkunde*, in the chapter: "Israel": "From the historical, legislative, religious and devotional books of the ancient Jews nothing serious may be expected, as regards medicine, and also dentistry." In my opinion, on the contrary, it is certainly worth noticing that the above mentioned—not even completely treated—material of the Bible and Talmud sufficiently demonstrates not only a respectable amount of dental knowledge, but also perhaps *the most advanced in this respect of all contemporary peoples of the ancient times*, especially if Katzelson's statement is also taken into consideration, according to which: "As to the ancient Greeks, on the basis of their remaining writings we know the limits of

[81] R. Ami Ben Nathan, contracted into Rabmi, contemporary and friend of R. Ashi (Josse), third century.

their knowledge in the art of healing, all that they did or did not know. On the other hand, of the ancient Hebrews we only know what they accidentally put into the Talmud. Possibly they knew very much more than may be found there (quoted from Nobel).

II. Later Development in the Ghetto

As main sources may be considered: The Shulhan 'Aruk;[82] Responsa (decisions) of the great rabbis; the anonymous booklet which appeared in the year 1530: "Artzney Buchlein wider allerlei kranckeyten und gebrechen der tzeen,"[83] commonly called "Zene Artzney" after its later editions; Fries,[84] Ryff,[85] Falcucci[86] were not accessible to me, but they are not decisive for our topic. As an introduction may I give a remark of the learned American historian of dentistry B. W. Weinberger[87] which is very worthy of consideration: "The unfortunate fault of our present dental historical knowledge is that so few of our historians endeavor to trace a statement to its original source."

After the formidable insurrection of 66-70, terminating in the capture of Jerusalem and the destruction of the Temple, the center of the national and religious life of the Jewish people throughout the world, the Jews dispersed along the shores of the Mediterranean. Thousands of Jews were made captives and reduced to slavery, passing from owner to owner and from land to land until their enfranchisement.[88] This enfranchisement indeed usually occurred very soon; owing to the close solidarity of the Jewish race, they had no difficulty in finding correligionists willing to pay the amount of their ransom. The Jews thus freed, instead of return-

[82] Edition: Kizur Shulhan 'Aruk by Rabbi Slomo Ganzfried. Hungarian translation by Chief Rabbi Dr. Leo Singer (Várpalota, Hungary).

[83] A facsimile edition by Gustav Budjuhn: *Die Zene Arznei* 1530. Facsimiledruck mit einer quellenkritischen Untersuchung. Mit Vorwort von Karl Sudhoff. (*Quellen und Beiträge zur Geschichte der Zahnheilkunde.*, Bd. II), Berlin, 1921; Christ. Greve: Die "Zene Artzney" nebst einer modernen Übersetzung derselben. *Deutsche Zahnärztl. Wochenschrift*, 1937, No. 36. So far 15 editions of this work have been located dating from 1530 to 1576. All but five are self-contained works; the others dated 1546, 1549, 1555, 1556, 1565 made up the ninth book of thirteen medical tracts that were published together under the title of "*Artzneybuch*" or "*Haus Apotech.*"

[84] Lorenz Fries: *Spiegel der Arznei*, 1518.

[85] Ryff: *Die gross Chirurgei.* Frankfurt, 1545.

[86] Nicolai Nicoli (Falcucci): *Sermo medicinalis III*, Venetiis, 1479.

[87] B. W. Weinberger: The Cause of Errors in Dental History, *Dental Cosmos*, 1933, No. 4.

[88] *The Jewish Encyclopedia.*

ing to Palestine, usually remained in the land of their former slavery, or wandering to others, there in conjunction with their brethren in faith established groups and later communities, living clustered together in the cities, apart, in separate quarters, in the ghetto, which was closed every evening by gates. In *short, the life in Exile, in the Galut.* Thus the Jews were separated from the host-peoples of different faith, but it must not be believed that this was a hermitic seclusion.[39] Not infrequently even some Christian people lived within the Jewish quarter, or some Jews outside it as particularly in Frankfort-on-the-Main.[39a] Regarding the contemporary medical profession it may be generally remarked that—especially in Germany—the body or abdomen-physician (specialist for internal diseases) was distinguished from the barbers, who practised as surgeons of a lower rank. In Worms, e. g. in 1492 the town physician is briefly called "body-physician." The medical profession became specialized early in those times; especially oculists are often mentioned, further hernia and testicle cutters (Bruch- und Hodenschneider), on the Rhine the stone-cutter (Steinschneider) was particularly indispensable.[40] The dentist stood lowest in estimation and was ranked among the itinerant quacks of the markets.[41] Both Christian and Jewish physicians were generally on a very low level of medical science. In trying to fathom the state of learning in Western Europe during the Middle Ages, we are not so much struck by the ignorance of the masses, as by the ignorance of the learned.[42] The hygiene of Jewry was entrusted to physicians who partly enjoyed a great popularity among Christian circles also.[43] The Princes of the Church often protested against the treatment of Christian patients by Jewish physicians,[44] but without success, for the Christians called them in spite of all.[44a] They quenched their scientific thirst by the

[39] Mendes dos Remedios, *Os Judeus em Portugal*, Coimbra 1895: "Logo ao romper do sol, uma vez abertas as portas do carcere, a turba-multa dos medicos e cirurgiões e tantos outros disputer-se-hia a preferencia no trabalho e nos interesses."

[39a] They were confined to a narrow, dark street, which from their sufferings they used to call "New Egypt."

[40] Heinrich Boss, *Geschichte der rheinischen Städtekultur, mit besonderer Berücksichtigung der Stadt Worms*, Band III, Berlin, 1899.

[41] Otto Stobbe, *Die Juden in Deutschland während des Mittelalters.* Braunschweig, 1866, and G. Wolf, *Zur Geschichte der Juden in Worms*, 1862.

[42] S. A. Hirsch, *A Book of Essays*, London 1905, Macmillan & Co.

[43] Abrahams, *Jewish Life in the Middle Ages*, London, 1896; Philipson, *Old European Jewries*, Philadelphia, 1894; Grätz, *Geschichte der Juden.*

[44] Rotter-Schmieger, *Das Ghetto in der Wiener Leopoldstadt*, Wien, 1926.

[44a] John Pfefferkorn (once a Jew) writes in his pamphlet "der Juden Veindt" (*The Enemy of the Jews*, 1509): "that no Jewish physician, of whom a great number existed at that time, could be trusted, because they intentionally killed Christians."

Hebrew sources of the Talmud [45] and of the Shulhan 'Aruk.[46] Whether they also used the "Zene Artzney" (which appeared in German, 1530) we can only judge indirectly by the fact of the many editions of this booklet, and also by their intercourse with Christian circles. It may be taken as quite certain that the works of the great Arabs, *Avicenna*, *Abulquasim* were not accessible to them, and even less those of the great Christian reformers of the age, Vesalius, Eustachius, Paré.

Therefore we may hardly report about an enrichment of their anatomical, physiological, pathological and therapeutic knowledge. What they worked with, was "always the moulding and re-moulding of the existing material in customary grooves and after approved methods" (Hirsch, S. A.). Thus for instance, if we compare their treasure of remedies for soothing pains caused by bad teeth, as revealed in the Shulhan 'Aruk, in the decisions of the great rabbis and also in the Zene-Artzney, with that of the Bible and Talmud, it is difficult to speak of a considerable progress. It was mostly experimentally and always empirically that some new means were added by good luck to the old ones, such as frog grease etc. A Salernitan physician (Platearius) happened to write in the twelfth century these honest words about this whole stock of drugs: "quod frustra esse didici," I have recognized that all this is good for nothing (Sudhoff).

It is only in two domains that the dentistry of the ghetto shows a remarkable progress: first, the operative treatment of the teeth (filling), and even more, to a much greater extent, prosthetic dentistry. Especially in the latter respect the achievement is quite singular among the contemporary peoples, a circumstance which forcibly introduces a parallel with the Etruscan dental technique of several thousand years before to which there is nothing similar in history. In order to be able to understand and appreciate this fact better we must first learn two ancient Hebrew religious prescriptions, the first of which is the "ritual bath," and the other concerns "walking out on Sabbath."

1. *The ritual bath ("mikweh").* In all cases of ritual impurity, quite particularly that into which a woman gets by bleeding from the genital organs ("niddah"), a hindrance to sexual intercourse with her husband [47] is created and therefore it was necessary for the person to be

[45] It was composed within a period of about 600 years, with several cultural epochs First edition of the Talmud Babli 1520, of the Talm. Jerus., 1523.

[46] Work of Joseph B. Ephraim Caro, born 1488, died 1575. The last great codifier of rabbinical Judaism. First edition Venice 1564. The book was for centuries and in part still is "the Code" of rabbinical Judaism for all ritual and legal questions.

[47] "A menstruous woman requires immersion" (II. Sam. XI, 2. 4).

immersed (" tevilah ") in a bath built in accordance with the rules laid down by the Rabbis. The ritual bath always formed one of the most important institutions of a Jewish community. Since the Dispersion the custom of observing the laws of purity [48] has on the whole fallen into disuse, except in the case of the impure woman (" niddah "). With regard to her the laws are still observed in most orthodox communities and therefore the ritual " mikweh " is still a necessary institution there, the neglecting of which was subject to heavy punishment, even if not always by an earthly court.

This is the often described " Jewish bath," as it has been practised up to the present day. Because of the requirement put by the Bible to bathe in " living water," i. e. in flowing (source) water, and further as a considerable quantity of water is prescribed for the ritual bath (40 " sea " — about 1400 pints), which is not always easily procurable, it regularly is situated in an underground room, in order to utilize the subsoil water also. In poorer, smaller communities these baths are incontestably on a lower hygienic level, but in the larger ones they are perfect. In Worms, e. g. there is an underground room several stories high, just as in Speier. Particularly splendid are the Jewish baths in Friedberg, in Berlin, in Frankfort-am-Main, in Vienna, in Budapest. Expressly luxuriously equipped are the ritual baths of the larger communities in America.

The ritual bath is not a hygienic institution in the proper sense of the word, but rather an exclusively and strictly religious one. Therefore an extreme strictness prevails with regard to this bath, especially as far as the " unclean " woman is concerned, the neglecting of which is a crime worthy of death, according to the Biblical law, even if the judgment and condemnation is not a matter of earthly judges (Lv. XX, 18).

The unclean woman must immerse her faultlessly clean, naked and *entire* body three times into the ritual bath, and *nothing separating* (" *hazizah* ") *is allowed to be between her body and the water*, otherwise it is *invalid* and no sexual intercourse is allowed with her husband. From this religious point of view the following measures of conduct result: a) All the pieces of clothing, adornment and jewelry must be taken off; b) The body must first be freed from all dirt (traces of blood, dirt under the nails, food remnants between the teeth [49] etc. (Miqv. IX, 2). There-

[48] " Cleanliness is next to godliness " (Mishnah, Sotah IX, 15).

[49] Shulhan 'Aruk, Chapt. CLX (Hilchot hafifah, the rules of the preceding bath), Paragr. 10: Before immersion into the mikweh she has to clean her teeth, as it may happen that food residues remain between her teeth. If she observes after the immersion that something is sticking between or on her teeth, the immersion is not valid. Religious

fore, after a thorough cleansing of her mouth and body, the woman takes a warm cleansing bath (" hafifah ") and goes only after that into the *cold* ritual bath. c) As to the " separating " (" hazizah "), i. e. that no interruption, no separating surface (not even a hair swimming in the water) is allowed to be found between the water and the immersing woman's body, and *also in the mouth there must not be such a matter*, although the water did not have to penetrate there in fact. To the judgment of this separating surface a further essential point is given by the so-called " *hakpada*," that is the " *strictly taking* " of the respective separating matter, namely whether the woman thinks of it, whether she lays stress on it or not. About this, and how all this is connected with the prosthesis, we shall soon read further details.

Joseph Caro writes in his Shulhan 'Aruk, Chapt. 198, Paragraph 11: The woman is bound to thoroughly clean her teeth before immersing into the mikweh. Later commentators complicated this place with the question, whether the *inserted teeth* form a separation (hazizah), namely between her body and the water, in which case they must be removed. In the decision of this question the above mentioned " strictly taking " (hakpada) plays an important role, and in this respect there arises a whole complex of questions, which is almost inscrutable, but which has the fortunate side that it gives us a glimpse into the knowledge of prostheses. Ganzfried's Kizur (excerpt) of the Shulhan 'Aruk only remarks in Chapter CLXI, Paragraph 11: The woman who has an inserted tooth should ask the qualified master of the law how she has to behave during the immersion. A rich literature of decisions exists concerning this question (Ture Zahab,[50] Chachmath Adam-Binath Adam,[51] Sefer Gidula Tahara,[52] Binjan Zion hachadaso,[53] Me Nidda,[54] Meïr Ash, etc.). It is only the decision of R. Meïr Ash which we shall treat more thoroughly, first, as it contains almost everything that is to be found in the former ones, second, as in it one of the oldest prosthetic systems is dealt with, and—last but not least—because of local patriotic reasons, as it was given in Hungary.

women eat no meat on the day of their ritual bath (Jore De'ah, Hilchoth Tevilas Noshim 187), for fibres of meat stick more easily than other food residues, and therefore it is to be feared that in spite of cleansing something remains.

[50] Ture Zahab, see remark 22.

[51] *Chachmath Adam* (*The Man's Wisdom*) and *Binath Adam* (*The Man's Cleverness*) are works of R. Abraham Danzig, in reality R. Abraham B. Zechiel Michel, born in Danzig 1748. *Chachmath Adam* appeared in Wilna 1812/16.

[52] *Sefer* appeared in Fürth (Austria), 1848.

[53] *Binjan Zion hachadaso*, also in Fürth, 1840.

[54] *Me Nidda* appeared in Zolkiev (Russia), 1835.

2. *With what is a woman allowed to walk out on the Sabbath?* (Sabbath Bame Isah Jôcô). In this question further information on prosthesis and even on filling of the teeth is given—as will be seen,—and therefore it is of a particular importance for our purpose. The following should be known, briefly, for its understanding: The religious Jew's freedom of motion is locally limited on the Sabbath ('Erub, Sabbath boundary), and quite particularly so is the *carrying* an object or any kind of burden from one place to another. The law concerning the transportation of objects from one place to another on the Sabbath distinguishes several sorts of places (" reshujot "), of which the following three may be mentioned: a) a place belonging to an individual (" reshut hayabid "); b) open spaces belonging to the public (" reshut ha-rabbim "); c) places such as the sides and corners of streets, and fields not enclosed, which can not be considered either as public or as private property (" karmelit "). According to the traditional interpretation of Ex. XVI, 29, the only space in which one is allowed to remove things freely is an enclosed space which is in the property of an individual; it is forbidden to remove on the Sabbath things from such a space to one of public property. *Likewise one is forbidden to transport objects for a distance of more than four cubits (" amma ") within an open space.*[55] (A cubit varies, according to different commentators, between 44 and 66 cm.)

In this prohibition an application to a prosthesis is found, which in the ancient Hebrew perception is not an artificial chewing organ of the mouth, but *an adornment* of it. If the woman walks out on the Sabbath with the inserted golden tooth, she could take it from the mouth: a) in order to boast of her richness before her friends, or b) because she had been ridiculed for the showiness of the gold. The artificial tooth, taken out of the mouth and carried in the hand, is no longer a jewel, but a burden, and the woman could fall into the temptation of carrying it beyond the limit of four cubits, i. e. to trespass against the above-mentioned Sabbath law. In order to check this, it is absolutely forbidden for her to walk out with a golden tooth on the Sabbath. With a silver tooth, which costs so little that everyone may have one made for himself, and which therefore is a sign of poorness, further because of its unshowiness, this is not to be feared and therefore one may walk out with it.

By the different comments on these two laws, namely that of the ritual bath and that of the restrictions in movement in the Talmud and in the decisions of the learned Rabbis, we obtain a clear view into the methods

[55] *The Jewish Encyclopedia.*

of prostheses and dental treatments of the ancient religious Jews, up to the Ghetto era of more recent periods.

Now we can turn to the clearer explanation of the respective conditions of R. Meïr Ash's decision. The state of affairs from which it arose is the following:

A woman possessed an inserted tooth cut of bone (shen thôthêbeth), which had been attached so strongly by the dentist that she could not remove it. Therefore she was compelled to immerse with it into the ritual bath. Her husband, following the counsel of the Shulhan 'Aruk, turned for information on the validity of the immersion to a law scholar, to Morenu [56] Nahum in Pest (the capital of Hungary).

Morenu Nahun's decision came, as it seems, as to a higher court, to Rabbi Meïr Ash [57] of Ungvár (Hungary), who in No. 75 and No. 76 of his collection of decisions "Imre Esh" (Sayings of Ash)[58] gave a detailed answer. This learned rabbi's real name was Meïr Eisenstädter, after Eisenstadt, his native town (in Hungarian called Kismarton),[59] one of the most famous Jewish communities of Hungary. This town name, written in two words: Eisen (iron) and Stadt (town), has "a" and "sh" for Hebrew initials letters, from which "Ash" was contracted,[60] and the rabbi figures as "Meïr Ash" in the Jewish response literature.

FROM THE 75TH DECISION OF RABBI MEÏR ASH

(Regarding inserted teeth and ritual bath)

Imre Esh, I. 75. With God's help, in 5610,[61] on the Tuesday of the weekly chapter "Shemini."

To the great scholar, the blooming olive tree, the man of perfect character, etc. Morenu Nahum, in the city of Pest.

In the case of the married woman who wore teeth cut of bone, which were so strongly attached by the uman that she could not remove them with her own hands [62] and therefore immersed together with the teeth.

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[56] Nowadays "Morenu" (our teacher), is the title of secular scholars, since the middle of the fourteenth century also for Rabbis and Talmudists.

[57] One of the greatest Talmudists of the nineteenth century, died at Ungvár 1861, also known after his later rabbinates, Meïr Gyarmat and Meïr Ungvár.

[58] Published after his death by his son at Lemberg (Poland) 1862.

[59] City in the county of Sopron.

[60] Such abbreviations are especially frequent in names of which the second part begins with the sound "s"; so "Lash" is put for Lichten-Stadt, and "Ash" for Eisen-Stadt.

[61] 1850, common era.

[62] Another similar story of such a strong attachment is told by Forestus (1522-1597), in his "Observationes et Curationes medicinales," of an aged man who was engaged to a

The woman's husband put the question to you, dear sir, and your clean heart could not decide on relief (permission),[63] and therefore the woman went to the uman again, who took out her teeth, and then the woman immersed for the second time into the water of the mikweh. The teeth belonged to the visible ones and therefore the woman wants to have them put back, but she does not want to neglect the immersion either, yet it is impossible that she should go to the uman harôfe on every occasion.[64] Dear sir, you treat the question comprehensively with your keen eye and knowledge and you incline in your arguments towards an alleviation and believe the immersion with the teeth must be allowed.[65]

You quote, dear Sir, the Gaon,[66] the prominent Thora-scholar, R. Ezekiel Landau's collection of decisions "Noda' bi-Yehuda,"[67] according to which the immersion is to occur in such a way that the water may reach even the concealed parts, but we do not think it necessary that the water should reach the inaccessible, i. e. inner parts, even if they were apt to be reached. Thus it should be understood also at the end of the Niddah tractate in Mordekai's[68] law codex, where he expressedly writes about women who have a loose hair: "as it strongly sticks together (namely the hair), it is to be regarded as an impermeable or concealed place, and as this does not make one unclean, it also cannot be taken for something separating." He means to say by this: because it does not make one unclean, it cannot be separating at the woman either, and yet it is separating, with which he certainly understands that the manner of wearing it (namely the hair) does not make one unclean. And as he begins with the "inaccessible" and "inner" place, his opinion refers in fact only to the inaccessible (inner) part, for every inaccessible (inner) part is concealed at the same time.

What is doubtful to you, dear sir, had already been asked of the Gaon of the Noda' bi-Yehuda long ago, see the decision Teruva Meahava Volume I, No. 39 and the following chapters. What the Gaon answers there, and also that Zikron Yosef[69] answered the same, and as was equally hinted by the gaon of the "Sidre

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young girl and who had his missing front teeth restored by teeth made of ivory, which a goldsmith attached for him with golden wire. *Otherwise the teeth should be made so skillfully that they may be removed at meal time.* But the Antwerp goldsmith attached the artificial teeth so strongly that on the counsel of Forestus he had to be called when the gum, the lips and the whole mouth became inflamed (quoted from Sudhoff).

[63] Namely before having carefully studied the question.

[64] Once the Rabbi says "uman" (craftsman) and then "uman harôfe," which means a higher rank ("medicus peritus"), an initiated person, an expert (in this case a "dentist"). It is dubious whether one can conclude from it the profession of "dental mechanic" (Zahntechniker) or "dentist doctor" (Zahnarzt). Most probably it is but a stylistic variant.

[65] Namely, after having studied the teaching of the wise men.

[66] The title of "gaon" was given to the heads of the two Babylonian academies of Sura and Pumbedita; in later times to celebrated teachers of the Bible and Talmud.

[67] R. Ezekiel Landau, Polish rabbi, born at Opatow in 1713, died as a great rabbi of Prague (Bohemia) in 1793; his work 'Noda' bi-Yehuda" (Responsa) appeared 1776.

[68] R. Hillel Mordekai, German halachist of the thirteenth century, author of the great legal code "Sefer ha-Mordekai."

[69] Joseph B. Menahem Mendel Steinhardt, German rabbi, born about 1720, died at

Tohorah,"[70] further what he remarks to the words of the Sidre Tohorah, namely that the concealed part has also to be so that the water might reach it, this he says in respect to the separation from the water, it is a cause for separation.

. . . . . .

Certainly it is clear that in this case of an inserted tooth only a rabbinic prohibition can be spoken of, but we must not relieve, nevertheless, what our wise men, blessed be their memory, told us.

. . . . . .

Dear sir, regarding your opinion that a place which since birth and according to its nature was not suitable for water to reach it, should not be considered as attainable by water, not even in case it becomes free from time to time, what led your heart, darling of our Lord, to find such a new thing for relief, which is without any foundation?

. . . . . .

But, dear sir, the permission which you seemingly think to be compelled to give, because so small a part is dealt with on which she (the woman) lays no stress,[71] appears to be plausible, for it had been attached artificially and serves her as adornment and beautifier, and therefore we have no reason to suppose that she cares for it or particularly thinks of it, as it does not render her ugly, having been prepared to adorn her, . . . and thus there is no reason for the supposition that she would lay stress on it. The evidence which you, dear sir, quote from Rosh's[72] explanation, that a ring which sticks to the finger while kneading dough is only separating if she (the woman) lays a stress on taking it off while kneading, as also Rabad[73] (Rabbi Abraham ben David) writes, and therefore the tooth as well,

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Fürth in 1776. One of the foremost Talmudists of his time, author of the work "Zikron Yosef" (Questions and Answers), Fürth, 1773.

[70] Elhanan B. Samuel (Sanwel) Ashkenazi, German rabbi of Schottland, near Danzig, born 1713, died 1780. Author of "Sidre Tohorah," novellae on the laws of Niddah in the Yoreh De'Ah. Berlin, 1783.

[71] This touches the above-mentioned question of "strictly taking" ("hakpada"): what is particularly thought of, what is strictly taken, is separating (hazizah), what is not thought of, what no stress is laid on, is not "separating" in the mikweh. Also Joseph Caro's rigorous opinion in the Shulhan 'Aruk should be mentioned here: Something that most people take into consideration is "separating" even if the woman does not think of it in the given moment, or if she never thinks of it but if the majority takes it into consideration. Furthermore: If something covers a greater part of her body, it is separating, even if people are not used to take it into consideration. In a similar way writes R. David ben Samuel Halevi (in short "Taz") in his Ture Zahab. R. Abraham ben Zachiel Michel has an easier interpretation in his work "Chachmath Adam" (119, 18): In my opinion inserted teeth are not separating objects. In the "Binath Adam": the inserted tooth is not a separating object, for it serves as an adornment and beautifier.

[72] Asher ben Jehiel, eminent Talmudist, born in Germany about 1250, died in Toledo in 1328, called "Rosh."

[73] Rabbi Abraham Ibn Daud (David) Halevi, called Ben Daud, also "Rabad" (I.), Spanish astronomer, historian and philosopher, born at Toledo about 1110, died a martyr about 1180.

for she never lays stress on removing it, on the contrary, she never thinks of doing so, thus it is a smaller part of which she never thinks, on which she never lays stress, this is a very correct and demonstrative argument.

. . . . . .

Therefore it is to be said that the firmly inserted tooth is no cause for separation, for it is so small a part which she does not think of, with which she does not occupy herself. But a further question must be examined, whether the dentist is not accustomed to remove the tooth in order to clean or beautify it, or for any other reason, in which case Rabad's concern, which he had in regard to the ring, comes into force also with regard to the inserted tooth. But if it is not to be feared that it will be removed on some occasion, then it is natural and evident that the immersion with the tooth is permitted.

Nevertheless, I wish with all my heart that other acknowledged authorities should accord with our opinion considering the permission, for I have written in a hurry. May the Almighty God give the good woman and her honest husband such offspring as common descendants who will make God and men rejoice.

These are the words of the modest little Meïr Ash.[74]

FROM THE 76TH DECISION OF RABBI MEÏR ASH

(In the same case)

Now I only answer in respect to the inserted tooth which we spoke of, and then I wrote to you that if the dentist is accustomed to remove the tooth in order to clean or beautify it, or for any other reason, in this case Rabad's concern, which he had in regard to the ring, arises also as to the tooth. To this you answered, dear sir, that in this case we gave the permission on the supposition that it is no cause for separation, so far as it only represents a small part, which she does not think of, which she does not take into consideration; but she cannot prevent the tooth from being removed by the dentist from time to time, for perhaps its attachment may become loose, and therefore you believe, dear sir, may your light be bright, that you must distinguish in correct deduction. But it has never been my intention to say that if she does it over longer periods (you know it well, learned master, that it must be removed every second or third year), for in this case, even after Rabad's opinion, it is no longer a negligible small part, only if she is accustomed to remove it if something happens to it which must be taken into consideration, as is often the case. But if a concern arose in such a way, then there is no object which would not become inferior (spoilt, worn) after a certain time . . . and also with the ring it is impossible that she would never take it off while kneading or cooking, in order to give it to the craftsman, as the Sabbath Tractate (62a) in the Talmud says: it often occurs that the woman gives the ring to her husband, in order that the artisan should repair it, and so he holds it in his hand until it arrives at the goldsmith. But as long as it is without any defect, she does not think of removing it, thus it a matter on which she lays no stress.

. . . . . .

[74] It is an ancient tradition that the great and modest master writes the word "little" to his name.

The Eternal's mercy may save us from all errors and heap his benefits soon upon us, these are the words of the little Meïr Ash.

What do we learn from these decisions in regard to a prosthesis? A prosthesis cut of bone is treated, probably for several teeth, whether lower or upper cannot be ascertained, which had been attached with wire to the natural teeth. Thus it was a prosthesis of the most ancient bridge system, as first mentioned by Abulcasis in the tenth century, and first sketched by Paré [75] at the end of the XVIth century. For what purpose did this prosthesis serve? Never as an artificial chewing apparatus, but always only to cover (to mask) the ugly gap caused by the loss of the teeth, that is to say *as a way of beautifying, as an adornment*, for which reason it is enumerated by the Talmud among the woman's jewels (Or. chajj. Chapt. 303). With the man, for whom every kind of showiness was prohibited, it is never mentioned.[76] Corresponding with this cosmetic aim, only the visible front teeth were restored, even in the most ancient, i. e. Etruscan times. Such artificial teeth were attached by wedging them into the gap between the natural teeth, in order that they might be easily removable during the meals and before the ritual bath.[77] This primitive and very loose attachment was soon replaced by a connecting device: the prosthesis was bound to the natural teeth by means of gold, silver wires or threads of silk. Another somewhat mysterious way of attachment shall also be mentioned. I have always found the passage remarkable in which Matthäus Gottfried Purmann,[78] the Breslau surgeon, communicates that the golden wire, by means of which the artificial teeth of bone are attached, is slipped through a hole which has been bored from outside inward through the natural crown of the tooth.

I have found the boring of such a hole so incredible that this passage was one more proof of my opinion that Purmann never practised dentistry or occupied himself with prostheses, and that this hole existed only in Purmann's imagination. Later Sudhoff has also expressed a similar opinion in the second edition of his *Geschichte der Zahnheilkunde*. In order to be

[75] Opera Ambrosii Parei. Parisiis M. D. LXXXII, p. 661.

[76] The very learned Chief Rabbi Dr. Leo Singer (Várpalota, Hungary) informs me in a letter that in post-Talmudic times men also wore prostheses and therefore in Chapter CLXXI, Paragraph 1 of the Shulhan 'Aruk, where such *female* objects are treated, which men are not allowed to wear, there is no mention about artificial teeth.

[77] Maimonides speaks of an attachment by pressure "nearly in the way of the mastic props pressed between the natural teeth, as found in the mouths of mummies." (Nobel, p. 135, remark 142.)

[78] *Neuer Lorbeer-Krantz oder grosse Wund-Artzney*, 1684.

able to explain this better I must point to a singular forensic question of the Talmud, to the so-called "Agunah," the state of the doubtful widow, who had no certain proof of her husband's death in a distant country and therefore could not marry again. For the recognition of her husband's corpse she had to point out unquestionable bodily signs. There were a great number of these, of course, among them also signs on the jaws and teeth: for instance strong prognathism; but big teeth, even very big ones were not accepted as such signs (Shulhan 'Aruk, Eben haeser XVII, 24). To this other commentators remark that this was only valid in the case of front teeth, for these teeth often vary in size, but an increase of the back teeth was regarded as a characteristic sign. A case is also mentioned, in which the missing person had a gap in the teeth, into which the molar exactly fitted which the widow had kept with her. To this case a remarkable passage is to be found in Ture Zahab, where "*the hole passing through the tooth*" ("*nekev mefulosh*") is mentioned as an indubitable sign. The quoted passage treats a concrete identification, and our source says: the witness spoke of a scar, the position of which he could not exactly give, and so this statement was no proof of personal identity, nor that of which of his eyes had a spot. This cannot be compared with the case of Rabbi Israel el Bruna [79] quoted by him (by the witness), in which "*nekev mefulosh beshen echod min hashinajim*" (— a hole passed through one of his teeth) "*dehanekev akma hu abar kidush meod*" (— the hole itself is a new [quite remarkable] thing) . . . and the widow was acquitted, although she could not tell the exact place of the hole.[80]

This is the hole bored through ("passing through") the crown from the labial to the lingual side, of which Purmann heard something and which was applied by the Jewish mechanics or dentists to attach artificial teeth, even at the beginning of the sixteenth century and probably even earlier.

To the question of the prosthesis attachment, with respect to their removability, we find another contribution in the Shulhan 'Aruk, Chapt. CXCVII (Garments of the dead etc.), Paragr. 13: "It is forbidden to make any profit from the garments of the dead, may he be a Jew or not, in the same way it is forbidden to make any use of the adornments attached to his body, or of the foreign hair woven into his own hair. Likewise: if he had any inserted teeth, these should be buried with him."

[79] Rabbi of Nikolsburg in Germany, about 1500.

[80] This could not have been a carious hole, for that was no "new," no "remarkable" thing. The passage of the Ture Zahab is in: Gloss to Chapter XVII, 31, Eben haeser of the Shulhan 'Aruk.

The commentators remark to this last passage: If only a dentist or someone else could remove a dead man's inserted teeth, they are not allowed to be taken from his mouth; if he could take them out himself, but had they been in the mouth at the hour of his death, they go with him; if they were not in the mouth, they do not go with him.

Whether a woman could release her connecting device before going into the ritual bath, is very doubtful, and how she could reconcile with her conscience the disregarding of this rigorous ritual prescription (hazizah), is just the topic of R. Meïr Ash's decisions. Later, probably when the custom of wearing artificial teeth became more general, the difficulty was lifted in such a way that most rabbis allowed the immersion with inserted teeth.

It should be well remembered that the case which R. Meïr Ash is treating in his above-mentioned decisions, did not occur in the mediaeval ghetto, but in the capital of Hungary in the middle of the nineteenth century. Considering the religious conservatism and seclusion of the pious Jews, we may certainly conclude that the above described prosthesis method had come down from an indeterminably far past and has been used from the time of the mediaeval ghetto up to our modern times.

Regarding the burying of artificial teeth we give excerpts from a very interesting question of R. Moshe Günsburg in Vienna and the relative decision of the most renowned Rabbi Mhram (— Morenu horav Rabbi Meïr Ash) of Eisenstadt (— Kismarton), which appeared at Sulzbach in 1738 (Seelot utesuwoth — Responsa, Part III, No. 33).

QUESTION NO. 33

(On the fourth day of the week, Teweth 15th, 5497 (= 1737) in Vienna)

Peace shall bloom to the cedar of Lebanon, to the vessel filled with new and ancient wisdom, until the coming of the Messiah: It is the teacher, the brilliant Gaon, the admired and excellent master Morenu Rabbi Meïr, may his light shine to us forever!

. . . . . .

Yet this was an extraordinary case which happened to us: A man, one of the just ones . . . was buried here last Sunday and in his mouth there was a prosthesis made of the bone of some unclean animal. The tooth being easily removable from the mouth, the question was put whether this should be done or should it be left where it was, to be buried with the dead. Standing at his grave, I said in haste that on the basis of my modest knowledge it seemed to me that the tooth should be removed and burnt like an object of the dead man's adornment, as Bach (Beth Chadas = "The New House," a commentary on Shulhan 'Aruk) teaches in § 349

with regard to hair, even if it is not plaited and bound together. . . . If, for instance, on a field, in which a grave is ploughed over, a bone of the size of a barley-corn is found and it is unrecognizable whether it originates from a tooth, which latter does not make one unclean, it must be burnt (Ohaloth, Paragr. III) . . . and this being so, in Erez Jisrael these (namely the prostheses) are not buried with him, for the reason which we have just mentioned. . . . There is another reason which speaks for it: why should we let an unclean tooth lie in his mouth when it is forbidden to bury wicked persons near the just ones. Many say, on the contrary, that the dead should be left as he wore it in his life, for perhaps the removal displeased him (namely his spirit), as he himself could have taken it out during his illness. (Here is an important hint considering the attachment of the prostheses.) Thus the case was left without having done anything.

My request to my teacher and master now is that he might let me know his high opinion in order that we should live and not die, and that the Torah should not withdraw from our mouth. The just master may restore the laws of purity and sanctify them in the course of his days.

Kind regards from the affectionate and true friend of your house,

Moshe, the son of the late R. A. Günsburg, of blessed memory.

ANSWER

Moshe, Moshe did not lose his taste and smell (i. e. wisdom and learning). May the pious man bloom like a palm-tree: It is the learned, the admired, the perfect one in piety and wisdom: Morenu R. Moshe Günsburg, may his light shine and beam!

I have received your letter, and after reading two or three pages, I saw the little question which you addressed to me: In the case of a dead man, in whose mouth a prosthesis was found, made of the bone of some unclean animal, it was doubted before the interment whether the tooth should be removed from the mouth and be burnt like an object of the dead man's adornment, and as we fear a loss of cleanliness (Taharah), it should not be buried with him, for if on a field which is ploughed over, a barley-corn sized piece of the above-mentioned bone is found, and it is not recognizable that it originates from a tooth, which latter does not make one unclean, it must be burnt, and for this reason in Erez Jisrael it is not buried with him. So far your letter!

I was much astonished about you, dear Sir, that you have such an unlikely (= hardly happening) fear that this grave would be ploughed over, it being written in the Tossafoth (P. I. Tract. Moed Katan 1. 5. p. 2., paragraph Menapeah Adam) that the dead, as a rule, were not buried so deep as to-day, and therefore it is not likely that the harrow reach the dead when ploughing, even if it goes three hand-breadths into the ground, therefore it is a matter which never occurs. . . . Even then a field where a grave was ploughed over which was to be considered as clean is dealt with according to the law of the Torah, and we have no concern because of the barley-corn sized bone, and it was only a prohibition of our wise men . . . thus it is clear for any case: if it be recognized that the bone has the shape of a tooth, no Terumah (heave-offerings or gifts to the priest) will be burnt therefore,

as a dead man's tooth does not make one unclean. . . . Thus in the case of a prosthesis there is also no cause to fear a false step, be it recognized as a tooth, it is not burnt; be it not recognized, it is to be burnt, according to the law, and one never comes into the danger of sinning.

And what you write, dear Sir, why should we allow the bone of an unclean animal in his mouth, this is also not valid, for in my opinion Newelah (= prohibition of animals not killed ritually and unclean) does not refer to this case. We are allowed to employ utensils made of bone, and there arises no fear of a prohibition or of disgust, for the quality of the Noten Taam (giving a taste) is not involved in bones, thus it is also said at the end of the Tractate Jadajim, Mishna 6.: The bones of an ass are clean.

It seems to me much more proper to bury the tooth with him than not to bury it and thereby to offer a possibility of making a profit with it.

I have written my modest view, and though it does not accord with your opinion, I have answered with great affection.

On Thursday, the 23rd of Teweth 5497 (= 1737).

Meïr, in the community of A. Sh. (= Eisenstadt).

In his book Nobel raises the question how the ancient craftsmen (turners, goldsmiths) or the "dentists" made the impression and the model of the tooth-gap, in order to be able to prepare a suitable prosthesis. He demonstrates that the ancient Jews knew wax and plaster well; especially the goldsmiths were extremely skillful, although this was not an esteemed trade.[81] We believe that the whole question is superfluous, because no impression and no model were neeeded for the preparation of these cosmetic prostheses which sat like bridges on the crest of the alveolar process. The technician worked only from a measure taken by the eye, an exact position of the prosthesis not having been required at all.[82]

From the decisions of Meïr Ash and other scholars

(Concerning the conduct with a prosthesis on the Sabbath)

In our second chapter, entitled: "With what is a woman allowed to walk out on the Sabbath?" we have revealed the essential side of this

[81] There were several trades regarded unfavourably by popular opinion. Goldsmiths were especially looked upon with disfavour because they stand for the most part in contact with women. *The Jewish Encyclopedia.*

[82] The invention of the wax impression is generally attributed to the above-mentioned Matthäus Gottfried Purmann. How could the invention of such an excellent *practical* remedy as the impression be made by a man who in fact never occupied himself with dentistry and not even with tooth extraction? Sudhoff justly remarks that this can only be a misunderstanding of his text. It is likely that Purmann only thought of a model previously shaped in wax which served as a pattern for the prosthesis which was to be cut of bone.

problem, from which it may be seen that there was a ritual cause for prohibiting the walking out with removable golden teeth on the Sabbath. The most important respective decisions and commentaries remain to be stated.

Talmud Babli Sabbath 57 a, Mishnah [83] I: With what is a woman allowed to walk out on the Sabbath? What is adornment and no burden, even if it is an adornment, yet the wise men have prohibited it, for she could take it off and show it to her companions and then carry it for a distance of four cubits. Gemara [84] (65 a): Rabbi (Jehuda ha-Nasi) [85] allows one to walk out with the golden tooth, the wise men forbid it. Rabbi Zerah [86] says: this we have learnt from the golden tooth, but it is generally permissible to do so with a silver one.

The fountain-head of the problem is really to be found with Rambam, [87] who writes in his work "Mishna Torah" ("The Deuteronomy") or "Yad ha-Hazakah" ("The Strong Hand") on the objects which are not allowed to be worn on the Sabbath (Hilkoth Sabb. XIX, 7): "neither with a tooth sitting in the gap of the lost tooth, nor with a golden tooth set upon the defective (black) tooth, is one allowed to walk out, but one may do so with a silver tooth, because it is less recognizable." The general rule is: it is forbidden to wear anything which may be regarded as a touching obstacle at the immersion in the ritual bath, and vice versa.

We have now reached the important question: What kind of teeth are these golden teeth of which the Talmud, the Mishnah, the Gemara, the Wise Men, R. Judah ha-Nasi I., R. Zerah, Rambam (Maimonides) and others are speaking?

From the Maimonides quotation we may quite surely conclude that *removable golden (or silver) shell crowns are dealt with*, which were simply put as a cover upon a deteriorated (black) tooth, or perhaps were slipped upon the neighbouring teeth by means of supporting rings, after the Etruscan fashion. [88] Such golden crowns were already made in Tal-

[83] Mishnah means "instruction," the teaching and learning of the tradition.

[84] Gemara: that which has been learned and transmitted to scholars by tradition; gained currency as a designation of the Talmud.

[85] R. Judah ha-Nasi I., called "Rabbi", born about 135, died about 220, common era.

[86] Zerahiah ben Isaac Ha-Levi Gerondi, known as "Zerah" and "Rezbi"; Talmudic author and liturgical poet of the twelfth century.

[87] Rambam Rabbi Moses ben Maimun, commonly known as Maimonides, the great Jewish sage, philosopher, scientist, astronomer, physician etc., Cordoba, 1135-1204.

[88] Nobel's argumentation (p. 92 and p. 136, remark 147) that Maimonides does not mean a golden shell crown, respectively his opinion, under which circumstances it yet might be regarded as such a one, is quite unfounded and therefore untenable.

mudic times, and then the practice continued in the mediaeval ghetto among the Jewish goldsmiths who were very skillful in those times.

In R. Meir Ash's 75th decision, written in Hungary in the middle of the nineteenth century, we find the following passages: " What you (viz. Morenu Nahum) mention to be in the Sabbath Tractate (45, 1), that she (namely the woman) should not walk out with the golden tooth, perhaps she will be despised or ridiculed because it is different from the other teeth and she takes it out . . . here we must discriminate, for there an *entirely golden tooth* is spoken of, which becomes visible as soon as she opens her mouth and it may be supposed that she will be ashamed, but if it were attached by means of invisible or unrecognizable wire, this would not be feared, because one may see the silver tooth just as well, for one may quite certainly observe the difference between a silver and a bone tooth, the white of the silver being much different from the white of the tooth, and yet it is not very discernible." From this rabbinical reasoning, too, the difference distinctly reveals itself between a golden shell crown which had been put upon the deteriorated tooth without any particular attachment and which therefore is at any time easily removable by the owner, and the non-removable normal inserted tooth which was attached by means of wires (shen thôthêbeth).

The removable golden shell crown, which was used from the most ancient times and was widely applied by the Jews of the mediaeval ghetto and made by Jewish goldsmiths, was quite unknown to other peoples (except the Etruscans, 3000 years B. C.), allows us to suppose that the golden shell crown on the first left lower remaining molar, which appeared in the year 1593 on the Christian boy Christoph Müller at Weigelsdorf (Silesia) and which caused so much sensation in the whole world in those times,[89] had been prepared by an itinerant Jewish goldsmith who knew this method from the ghetto.

The filling of the teeth

What we learn about this subject in the conventional history of dentistry, may be classed into three strictly different activities. First, the most ancient (still being practised) filling of the cavity of the aching tooth with pain-soothing remedies, on which the most ancient record may be found in the Babylonian tooth-vermin text (Brit. Mus. No. 55547); second, as a preparation for tooth extraction, in order to prevent the fracture of the hollow crown the cavity is stuffed with various matters, such

[89] Jacobus Horstius, *De aureo dente*, 1595.

as slate wrapped round with wad or linen impregnated by mastic or other resins, with lead (plumbum, " Plombieren "), zinc, iron (" aber was man gehan kan das sich darein schicket ausfülle auff das so man yhn mit dem tzenglichen angreifft sich nicht zusammengebe und vorbreche," Zene-Artzney 1530); third, as a conserving remedy for the dentine healed from caries, and for the restoration of the anatomical form of the crown, which is the actual idea of the filling, first executed with gold foils by Arculanus in the middle of the fifteenth century (" ubi non fuerit multus recessus a mediocritate, impleatur cum foliis auri "). The first procedure is practised also at present, as mentioned before; the second one, as perfectly senseless and useless, was cancelled before long; the third fullfils its purpose only from the time when we learned the shaping of the dental cavity. (First experiment by Giovanni Vigo, last perfection by the American G. V. Black).

Concerning the ancient Jewish contribution to this doctrine, it should be remarked that in the Talmud there is nothing to be found about the filling of the teeth in the third of the above-mentioned senses. If the lexicographer T. W. Levy [90] endeavours to interpret the passage Sabb. 64: " Rabbi allows the prosthesis and the golden tooth, the wise men forbid them," in such a way that " the golden tooth " should mean a gold filling, then this is based, as demonstrated by Nobel, on an incorrect reading variant of the text. Besides Nobel's philological arguments, the general dental historical reasons, too, point to the plausibility of Nobel's opinion.

But from post-Talmudic and mediaeval ghetto periods we have testimonies for the fact that with respect to filling therapeutics the ghetto dentistry stood on a higher level than the contemporary non-Jewish. Later decisions give us interesting information to this item, and this again in connection with the immersion in the ritual bath and the prohibition of walking out on the Sabbath. Shulhan 'Aruk says in the already quoted Chapter CLXI, Paragr. 11, that the woman shall ask for the counsel of the qualified master of law-interpretation on her conduct in the ritual bath, not only in the case of inserted teeth, but also *if she has a filling in her carious tooth.* Rabbi Abraham Danzig's decisions give us valuable information in this direction. In his previously quoted work " Chachmath Adam " (Hilhot Nidda, Chapt. 119, Paragr. 18) we read as follows: In my opinion inserted teeth do not form a cause for separation (hazizah), *but that with which the doctor fills the cavity of the tooth in order that no air may get into it*, that matter is a cause for separation.

[90] *Chaldäisches und Neuhebräisches Wörterbuch*, 1876-1889.

Here we first have a *direct hint at the conserving purpose of the tooth-filling*, according to the tradition of the ghetto.

In the "Binath Adam" we learn more details about it. There the question is put: With women who have inserted teeth or with women who have the toothache, because their tooth is carious, does it form a cause for separation at the immersion, *if the physician filled the hole in the tooth with wax or lead in order to prevent the entrance of air into it—but the tooth does not ache any more?*

It should be well remarked that a difference is made in that relation *whether the tooth is aching* (in which case the filling serves a *healing purpose*) or if the filling has only the cosmetic purpose to make the defect of beauty caused by the carious tooth disappear, as will more distinctly be seen from the following.

The answer to the above question is: "On the basis of all these (in the preceding a longer argumentation on cosmetics, blood and fat spots etc.) it may be declared that the inserted tooth is not a cause for separation either, as it serves as a means for adornment and beautifying, *but that which is filled into the hole of the tooth, serves as a remedy and is therefore a cause for separation, and she would take it out if it were not a remedy.*" A clear proof to this is what Rambam (Rabbi Moshe ben Maimun) writes in the Sabbath-law, Chapt. 19: "She must not walk out either with a tooth that is in the place of a tooth removed from the mouth, or with a golden tooth which is lying over her black tooth, which is on the tooth, but she may walk out with a silver tooth, for this is more difficult to recognize." And it is a general rule that one must not go out on the Sabbath with an object that forms a cause for separation at the immersion. But here the question may be put: why is one allowed to walk out with a silver tooth, for it is quite certainly permissible to walk out with it, thus it is no hazizah, but for another cause. With the golden one it is not allowed, for she might be ridiculed, but the silver tooth is not noticed, therefore it is allowed. From this further follows: *that with which our teeth are filled, forms also no obstacle, even if it lies upon a black tooth, but this is similar to the tooth-filling, that is, it serves generally for beautifying*, and everything that serves for beautifying, is no hazizah, no separation, even if its material remains there (a hint to colouring matters, blood-spots etc.). *The contrary is true if a tooth-filling is dealt with, which only serves for healing purposes and which she would not have had inserted if she had not had the tooth-ache*, therefore it is hazizah, separation.

From this answer it may be seen that the filling of teeth was very

popular in the ghetto, for otherwise it would not have formed the subject of several decisions; that there were fillings for cosmetic purposes—as to immersion this falls under the same judgment as the regular attached but removable inserted tooth (shen thôthêbeth) and the silver shell crown; further that there were fillings for healing purposes — *provisional fillings* with which it was prohibited to immerse or to walk out on the Sabbath, as in the case of the golden shell crown, only with other motivation. Regarding the procedures, materials and instruments of filling, we obtain no further details.

Other decisions, as for instance in Meh Nidda, Chapt. 198, in the Binjan Zion hachadoshot 57, give the same information.

I cannot close this modest historical work of mine without expressing my sincerest gratitude to the Very Reverend Chief Rabbi of Várpalota, Dr. Leo Singer, for his unselfish and valuable literary support in interpreting Hebrew texts. I must sincerely confess that I could not have undertaken and much less accomplished my work without his support.

THE FIRST CLINICO-PATHOLOGICAL CASE HISTORY OF ANGINA PECTORIS: SELF-DIAGNOSIS BY AN ANONYMOUS PHYSICIAN: AUTOPSY BY JOHN HUNTER: REPORTED BY WILLIAM HEBERDEN IN 1772 *

HAROLD N. SEGALL †

Almost two hundred years ago William Heberden first recognised the group of symptoms which he described twenty years later, giving it the name angina pectoris. His communication to the College of Physicians was made on July 21, 1768 and was published in the second volume of *Medical Transactions of the College of Physicians in London* in 1772.[1] In March of that year a London physician, who has remained anonymous, after reading what Heberden had written, diagnosed himself as a case of angina pectoris. A few weeks later he wrote a letter to Heberden, describing his symptoms and stating he had left directions in his will that in the event of his death, Heberden should be given permission to have an autopsy done. Three weeks after the physician sent this letter he died, and Heberden invited John Hunter to perform the autopsy. This proved to be the first postmortem examination in a case of angina pectoris diagnosed during life, although Heberden declared that by 1772 he had met with about 50 cases.

In his book *Commentaries on the History and Cure of Diseases*[2] written in 1782 Heberden devotes most of chapter 70, " Pectoris Dolor," to the subject of angina pectoris. He mentions that he had seen " nearly a hundred cases " yet he refers to only one postmortem examination, that of this anonymous physician. What a precious case this was for

* Part of an Address delivered at the Annual Meeting of the Clinton County Society, Plattsburgh, New York, November 1944.

† From the Department of Medicine, McGill University.

[1] Heberden, William. Some Account of a Disorder of the Breast. *Med. Trans. Royal Coll. Phys.*, London, 1772, 2, 59.

[2] Heberden, William. *Commentaries on the History and Cure of Disease.* Translated by William Heberden, Jr., London, 1802.

Heberden! He had not had the opportunity to meet or examine the patient, yet this was the only occasion he was afforded to search for the cause of symptoms in about 38 years of clinical experience during which he was aware of the syndrome which he was the first to describe. The profound insight revealed by the clear and complete description of his symptoms and of his thoughts about them, together with the generous scientific spirit manifested in the provisions made for an autopsy, establish this letter[8] from the anonymous physician among the classics of medical literature. In his first communication about angina pectoris, Heberden did not describe any single case completely, but presented a general clinical picture referring to all the variations he had observed. The case report which is here reproduced in full is the first in which a single case is described as well as the first in which an autopsy was performed:—

"Soon after the publication of the second volume of the *Medical Transactions*, I received the following anonymous letter:

Sir,

Seeing, among the extracts from the Medical Transactions in the Critical Review of last month, your account of a disorder, which you term the angina pectoris, I found it so exactly correspond with what I have experienced of late years, that it determined me to give you such particulars, as I can recollect at those times to have felt; more especially as some sensations have frequently led me to think, that I should meet with a sudden death. I am now in the fifty-second year of my age, of a middling size, a strong constitution, a short neck and rather inclined to be fat. My pulsations at a medium are about 80 in a minute; the extremes, when in a perfect state of health, beyond which I scarcely ever knew them, 72 and 90. I have enjoyed from my childhood so happy a state of health as never to have wanted, nor taken a dose of physic of any kind for more than 20 years. As well as I can recollect, it is about five or six years since, that I first felt the disorder which you treat of; it always attacked me when walking, and always after dinner, or in the evening. I never once felt it in a morning, nor when sitting, nor in bed. I never ride, and seldom use a coach; but it never affected me in one. The first symptom is a pretty full pain in my left arm a little above the elbow; and in perhaps half a minute it spreads across the left side of my breast, and produces either a little faintness, or a thickness in my breathing; at least I imagined so, but the pain generally obliges me to stop. At first, as you observe, it went off instantaneously, but of late by degrees; and if, through impatience to wait its

[8] Heberden, William. A Letter to Dr. Heberden, concerning the Angina Pectoris; and Dr. Heberden's Account of the Dissection of One, who had been troubled with this Disorder. *Med. Trans. Royal Coll. Phys.*, London, 1785, 3, 1.

leaving me entirely, I resumed my walk, the pain returned. I have frequently, when in company, borne the pain, and continued my pace without indulging it; at which times it has lasted from five to perhaps ten minutes, and then gone off, as well as I can recollect, rather suddenly, as it came on, than lessening gradually. Sometimes I have felt it once a week; other times a fortnight, a month, or a longer time, may elapse without its once attacking me; but, I think, I am more subject to it in the winter, than in the summer months. As, when the pain left me, I had no traces of having the least disorder within me of any kind, either from spitting blood, or any corrupted matter, nor ever entertained the least thought of any abscess being formed, I never troubled myself much about the cause of it, but attributed it to an obstruction in the circulation, or a species of the rheumatism.

I shall now proceed to acquaint you with those sensations, which to me seem to indicate a sudden death; but which, not being concomitant with the above-mentioned disorder, I am ignorant whether they are to be attributed to it or not. I have often felt, when sitting, standing, and at times in my bed, what I can best express by calling it an universal pause within me of the operations of nature for perhaps three or four seconds; and when she has resumed her functions, I felt a shock at the heart, like that which one would feel from a small weight being fastened to a string to some part of the body, and falling from the table to within a few inches of the floor. At times it will return two or three times in half an hour; at other times not once a week; and sometimes I do not feel it for a long time: and I think I have been less subject to it for a year past, than for several former ones. As you have mentioned several, who within your knowledge have died suddenly, that were troubled with the angina pectoris, I suspect they were subject to what I have delineated, as I think that much more likely to occasion a sudden death, than either of the causes to which you attribute it. But, be the cause what it may, if it please God to take me away suddenly, I have left directions on my will to send an account of my death to you, with a permission for you to order such an examination of my body, as will shew the cause of it; and, perhaps, tend at the same time to a discovery of the origin of that disorder, which is the subject of this letter, and be productive of means to counteract and remove it.

I am, Sir, Yours,

UNKNOWN."

"The foregoing letter seems to have been written in such a sensible and natural manner, that the writer would probably neither mistake his own feelings through fancy, nor misinterpret them through affectation; and therefore I judged it worthy to be communicated to the College, both in justice to the temper and judgment of the author, and as a just and original picture of this disorder.

"In less than three weeks after he had sent this letter, I was informed

that in the midst of a walk, which he was taking after dinner, he leaned against a post, and begged a passenger to assist him, by whose help he reached a neighbouring house, where he vomited much, and was bled; but died in less than half an hour. At the same time I was acquainted, that, by a paper found in his will, if he died suddenly, he had desired, that I might immediately have notice of it, in order to have the body opened and examined. I used my best endeavours, that such a benevolent intention should not be frustrated, by procuring that experienced and accurate anatomist, Mr. J. Hunter, to open the body, which was done within 48 hours after his decease. But, upon the most careful examination, no manifest cause of his death could be discovered; the seat of the disease having been, as we may suppose, in some of those parts, the functions of which not being well understood in life, we can find no traces of their disorders after death.

"In general the viscera were well formed, and in a sound state, with marks of great robustness. The contents of the thorax were examined with peculiar attention, particularly the heart with its vessels and valves, and were all found to be in a natural condition, except some few specks of a beginning ossification upon the aorta, and some adhesions of the lungs to the pleura on the left side. The left ventricle of the heart was remarkably strong and thick, and as perfectly empty of blood, as if it had been washed. Nothing extraordinary could be perceived in the brain, unless that there was rather more water in the ventricles, than is common for such an age. It was very remarkable, that the blood was no where coagulated, and did not coagulate even after being more than two hours exposed to the air; but at the same time could not be called perfectly fluid, being of the consistence of thin cream; but there was no separation of any of its component parts.

"This anatomical examination, for which I acknowledge myself much indebted to the manly sense and benevolent spirit of this worthy man, though it do not inform us what the cause of the disease was, will however have its use by informing us what it was not. For since it was not owing to any mal-conformation, or morbid destruction of parts necessary to life, we need not despair of finding a cure; and as there were no appearances of inflammation or scirrhus or abscess, which in the former volume I mention as possible causes; we must not seek the remedy in bleeding and purging, and lowering the strength, but rather in the opposite class of medicines, which are usually called nervous and cordial, such as relieve and quiet convulsive motions, and invigorate the languishing principle of life.

"The sensation, described in the letter, of an apparent suspension of life for a few seconds, is what I do not remember to have ever heard mentioned by any patient besides this; and although I say, in the former paper upon this disorder, that I have seen it in twenty persons, I may truly say, that I have seen it in fifty. In this particular case, that universal pause of the vital actions is said to have been felt, when the patient was sitting, standing and at times in his bed. Now, as he was seized while he was walking with those symptoms which ended in his death (which I remember to have happened to others of his fellow-sufferers) it may seem probable, that he lost his life rather by an extraordinary aggravation of the angina pectoris, than of this particular sensation; but this must be decided by future experience."

* * *

Since Heberden wrote this last sentence, the "future experience" of 172 years has accumulated, and it is interesting to speculate about the pathological physiology of this case in the light of modern concepts of coronary circulation and of heart disease. The beautiful description of cardiac arrhythmia associated with a sense of suspended animation for a few moments suggests one of the various irregularities characterised by ventricular diastole of unusually long duration followed by a very strong heart beat. Premature ventricular ectopic beats, paroxysmal auricular or ventricular tachycardia of very short duration, transitory A-V block and sino-auricular block merit consideration in this order of likelihood. Dr. Anonymous may have guessed correctly when he thought that this aspect of his syndrome was the dangerous one, for he may have died of paroxysmal ventricular tachycardia which ended in ventricular fibrillation.

The fact that Dr. Anonymous had never experienced cardiac pain at rest strengthens confidence in the accuracy of the postmortem observations which failed to reveal any disease of the "heart and its vessels and valves." Had he mentioned a long episode of pain either at rest or during exertion, it would be permissible to think that even John Hunter may have overlooked arteriosclerotic stenosis or subintimal haemorrhage producing stenosis, or thrombotic occlusion of a coronary artery.

Neither John Hunter nor anyone else was then aware of the fact that the symptoms which Heberden described were associated with abnormalities of the coronary arteries. Sir Everard Home, his pupil and brother-in-law, wrote a detailed account [4] of John Hunter's illnesses and the manner

[4] Hunter, John. *A Treatise on the Blood, Inflammation and Gun Shot Wounds.* Pre-

of his death in 1793, and of what was found at the postmortem examination. In the light of modern knowledge it appears that a year after John Hunter performed the autopsy on Dr. Anonymous he himself suffered from his first attack of coronary occlusion with myocardial infarction. Then during most of the next 22 years—years of great activity in medical and surgical research and teaching, as well as in practice—he had symptoms of coronary artery disease. During acute illnesses he was attended by several famous physicians—Sir George Baker, who made great contributions to the study of lead poisoning, Sir David Pitcairn and Mathew Baillie, one of the five men who carried the famous Gold-headed Cane, and others, but Heberden is not mentioned. Hunter's friend, Edward Jenner,[5] diagnosed angina pectoris after meeting him during a holiday in 1778, and wrote to Heberden about Hunter and also about another case of angina pectoris which, at autopsy, revealed arteriosclerosis of the coronary arteries; in one artery he found "a firm fleshy tube," which in modern language would be called a thrombus. Then referring to Hunter he writes, "Should it be admitted that this is the cause of the disease, I fear the medical world may seek in vain for a remedy and I am fearful (if Mr. H. should admit this to be the cause of the disease) that it may deprive him of the hopes of a recovery." Thus Jenner wrote to Heberden rather than to his friend Hunter about his observation on the coronary arteries in order to spare Hunter's sensitive feelings. The autopsy on Hunter revealed scars of old infarction on the posterior wall of the left ventricle and auricle and the "coronary arteries and their branches . . . were in a state of bony tubes which were with difficulty divided by the knife." It would be so interesting to know if John Hunter might have had a dream such as Osler described; if he did, it has not been recorded. Dr. W. W. Francis, the librarian of the Osler Library of McGill, has kindly permitted me to quote him as follows about this dream: "Osler, like most Canadians of his time and all Englishmen, except Sir Clifford Allbutt, said angī́na, not ǎngĭna, which is one of the few doubtful terms to be more "correctly" pronounced by American than by English doctors. Osler had a vivid dream in which he watched his own autopsy being performed at Oxford in the presence of Dr. Welch of Baltimore and Sir Clifford Allbutt. The pathologist, on opening Osler's heart, said "Yes, ǎngĭna

fixed with a short account of the author's life by his brother-in-law Everhard Home. Philadelphia, Thomas Bradford, 1796.

[5] Baron, John. A Letter from E. Jenner to Dr. Heberden, 1778. From *The Life of Edward Jenner*, London, 1838, 1, 39.

pectoris," and Osler remarked, "That's right, X; whenever Welch or Allbutt is present I always say ăngĭna." It was only when his intestines were all out and being cut up that Osler realised that he was permanently dead, and the shock woke him!" Perhaps if Hunter had had such a dream he might have consulted Heberden, who outlived him by about eight years. Thus Heberden might have attended the autopsy and seen a second postmortem in a case of angina pectoris and one in which the coronary arteries were arteriosclerotic to a great degree.

Institutionum

Anatomicarum secundũ Galeni sententiam, ad candidatos Medicinæ, libri quatuor, per Ioãnem Guinterium Andernacum Medicum.

PARISIIS
Apud Simonem Colinæum.
1536

INSTITV
TIONVM ANATO
MICARVM SECVNDVM GALE
ni sententiam ad candidatos Medicinæ Libri Quatuor, per Ioannem Guinterium Andernacum Medicum.

BASILEAE,
M. D. XXXVI.

THE TITLE-PAGES OF THE PARIS AND BASEL EDITIONS OF GUENTHER'S *Institutiones*

Bibliographical evidence indicates that the Paris edition preceded the Basel, and a detailed [illegible] The photostat of the title-page of the

Bibliographie d'ouvrages publiés chez Pierre Gallimard, Paris, rue Sébastien-Bottin, 15 (7e arr.)

NOTES AND COMMENTS

THE *EDITIO PRINCEPS* OF GUENTHER'S *INSTITUTIONES ANATOMICÆ*

JOSIAH C. TRENT

Dr. Harvey Cushing, in the third chapter of his *Bio-Bibliography of Andreas Vesalius*,[1] treats of the *Institutiones Anatomicæ* of Johann Guenther. He cites as the *editio princeps* of this work the Basel edition of August, 1536, printed by Balthasar Lasius and Thomas Platter, and remarks that he has not been able to trace a copy of the Paris edition of the same year, which is cited by De Feyfer and Roth.[2] These statements, together with the fact that I possess a copy of the Paris edition, led me to compare it with the Yale copy of the Basel edition.[3] Facts uncovered in the course of the comparison seem to establish beyond doubt the priority of the Paris edition.

The scanty biographical information available certainly indicates such priority. As Cushing points out, Guenther was teaching in the University of Paris in 1536;[4] during this year he issued two works from the press of Simon de Colines, the *Institutiones* and an edition of the *Opera Diversa* of Galen, the dedication of which is dated, "Paris décembre 1536."[5] Under these circumstances it would seem probable that the first edition of his anatomical manual would be printed near at hand.

The proof of priority, however, lies in the bibliographical data which follow:

[1] New York, Schuman's, 1943.

[2] Cushing, pp. 44, 47.

[3] This comparison was made possible through the courtesy of Dr. John F. Fulton and Miss Madeline Stanton of the Yale Medical Library.

[4] P. 44; see also Guenther's preface to the 1539 edition of the *Institutiones*, cited by Cushing, p. 49. L. A. P. Herissant, in his *Eloge historique de J. Gonthier* (Paris, 1765, p. 34 ff.), indicates that Guenther left Paris in 1537.

[5] See Renouard, *Bibliographie des Editions de Simon de Colines, 1520-1546*, Paris, 1894.

PARIS EDITION	BASEL EDITION
Institutionum / *Anatomicarum secundũ Galeni sen* / *tentiam, ad candidatos Medicinæ,* / *libri quatuor, per Ioãnem Guinte-* / *rium Andernacum Medicum.* / [printer's device] / PARISIIS / *Apud Simonem Colinæum.* / 1536 /.	INSTITV / TIONVM ANATO / MICARVM SECVNDVM GALE / ni sententiam ad candidatos Medici = / næ Libri Quatuor, per Ioannem / Guinterium Anderna = / cum Medicum. / [printer's device] / BASILEÆ, / [single rule] / M. D. XXXVI.
8vo. A-I^8, K^4. pp. [13] + 1-136. 29 lines + headline and signature line, 117 (127) x 58 (71) mm.	8vo. A-L, a^8. pp. [1]-175 + [16]. 24 lines + headline and signature line, 106 (116) x 64 (80) mm.
A1^a, title-page; A1^b, blank; A2^a-A7^b, dedicatory preface; A7^b, list of errata; A8^{a-b}, blank; B1^a (p. 1)-K4^b (p. 136), text of the *Institutiones.*	A1^a, title-page; A1^b, blank; A2^a (p. 3)-6^b (p. 12), dedicatory preface; A7^a (p. 13)-K6^a (p. 155), text of the *Institutiones*; K6^b (p. 156)-L8^a (p. 175), "Georgii Vallæ Placentini De Hvmani corporis partibus . . ."; L8^b, list of errata; a1^a-a7^b, index; a8^a, colophon: "Basileæ, per Balthasarem Lasium & Thomam Platterum, Mense Augusto 1536"; a8^b, blank.

From the above information it is apparent that the Paris printer had in hand, on going to press, only the text of the work. This he began to print, lettering the first quire "B" and numbering the first page "1." The preliminaries—title-page and dedicatory preface—were delivered to him at a later date, and he printed them on quire A, adding on A7^b a brief list of errata for the work, conclusive proof that this quire was the last printed, and leaving A8 blank. The Basel printers, on the other hand, must have worked from a complete manuscript or from a copy of the Paris edition, for they evidently started printing with the title-page (A1^a, p. [1]) and printed straight through; the text begins on A7^a, and the errata list appears at the end of the text. Bibliographical evidence, therefore, reveals that the Paris edition was the *editio princeps.*[6]

This brief study has raised several other interesting problems. To which text was Vesalius referring when he remarked in his preface to the Venice, 1538 edition of the *Institutiones* that "due to the excessive haste demanded by the printers and their negligence" the work "is not

[6] A. Esdaile remarks: "Where edition A collates with preliminaries separate, and edition B with the text following on without a break, A is the first edition" (*A Student's Manual of Bibliography*, London, 1931, p. 228). The application of this bibliographical principle was pointed out to me by Miss Ellen Frey of Duke University Library.

free from errors"?[1] Vesalius must have known both the Paris and the Basel editions. He was in Paris, studying under Guenther, at the time when the work was published and would certainly have seen the Colines volume, his own first appearance in print; on the other hand, he included in his Venice edition the Valla treatise, which was added by the Basel printers. Did Vesalius use both texts in preparing the Venice edition, or the Basel alone? Such questions can be answered only after careful comparison of the three editions. As we have seen, the Paris printer alone received the manuscript in instalments, and it seems probable that it was he who demanded "excessive haste" of Guenther.

It is extremely regrettable that Dr. Cushing, who described the Basel edition as "handsomely printed," could not have seen the Paris edition, which is a far finer specimen of the printer's art and typographically far more correct.

[1] Quoted by Cushing, *op. cit.*, p. 46.

MEDICO-HISTORICAL NEWS AND ACTIVITIES

AMERICAN ASSOCIATION OF THE HISTORY OF MEDICINE

Captain George Rosen Receives Columbia Award

A member of the Association, Captain George Rosen of New York, was recently awarded the Grant Squires Prize of Columbia University for his book *The History of Miners' Diseases, a Medical and Social Interpretation* (New York, Schuman's, 1943). This prize is given every five years for the most original and outstanding contribution in the field of sociology by a graduate student of the University during that period. The presentation was made on June 5, 1945, at the commencement exercises.

NATIONAL NEWS

The University of Rochester Library has acquired a group of 186 letters, once in the possession of Dr. Edward Mott Moore, known as the founder of the Rochester Park system and for more than 60 years a leader in the field of medicine and the civic life of Rochester. He was a trustee of the University of Rochester for 30 years.

The collection covers in general the period from 1834 through 1865. While the papers are valuable as biographical data, they also have a broad interest for students of the social life of the period, and more particularly to students of the medical history of the middle 19th Century, according to John R. Russell, university librarian.

The papers have been placed on deposit by Edmund W. Moore, son of Samuel Prescott Moore and grandson of Dr. Edward Mott Moore.

Son of Quaker parents, Dr. Moore studied at schools conducted by his father, beginning the study of Greek and Latin when he was four years old. After graduating from the University of Pennsylvania Medical College, he began his medical career in Rochester in 1840 and continued until his death in 1902. In his early career he became associated with St. Mary's Hospital and was its chief surgeon for 30 years. He was at various times president of the Monroe County, Central New York and New York State Medical Societies, the American Medical Association and the American Surgical Association.

Dr. Moore's activities were not confined to medicine and public health. During the middle 1840's he took an active part in the futile attempt to found a college in Rochester, hoping that a medical school might be established as an integral part of it.

When the University of Rochester was founded in 1850, he became its ardent supporter, was elected to its Board of Trustees in 1872, and became president of the board in 1893, holding the position until his death. He was a pioneer in the movement to prevent the spread of infectious diseases, and a promoter of the movement to provide Rochester with a supply of pure water and a system of city sewers.

Dr. Moore was instrumental in establishing the Rochester City Hospital and the Infant's Summer Hospital. Perhaps most important, he advocated and by persistent effort brought about the establishment of Rochester's great park system. At the time of Dr. Moore's death in 1902 at the age of 87, Dr. Rush Rhees, then president of the University of Rochester, said of him:

"There was combined in him not only the foresight of a great physician and surgeon, but a man who gave to his city and to his people all that was in him during a very long life."

NEWS FROM EUROPE

England

A recent communication from Dr. Ernest Finch of Sheffield, England, informs us that he has been appointed Honorary Lecturer on the History of Medicine at the University of Sheffield.

ERRATA

It has been brought to our attention that the quotation in Dr. Bernard Aschner's article "Empiricism and Rationalism in Past and Present Medicine" (cf. this *Bulletin*, 1945, Vol. 17, p. 275) which was attributed to Dr. Iago Galdston is not a direct quotation, but rather Dr. Aschner's interpretation.

BOOK REVIEWS

LUDWIG ASCHOFF. *Rudolf Virchow. Wissenschaft und Weltgeltung.* Hamburg: Hoffmann und Campe, 1940. 95 pp.

One of the happier hazards of war has placed into my hands this little book which under present European conditions might be already a rare book. We trust that other historians of medicine will partake in our interest in this appraisal of the master of pathology, formulated shortly before his death by the greatest German pathologist after Virchow.

Aschoff devotes about one tenth of his study to a reexamination of "Zellularpathologie," and concludes that it is still the foundation of pathological anatomy. Then, contrary to the announcement of his own introduction that he would entirely abstain from a discussion of Virchows "unjustifiable" political ideas, the author turns just to the non-anatomical aspects of Virchow's thought and step by step opposes the then ruling Nazi ideology with quotations from Virchow. Against the protection of all sorts of quackery by the Nazi leadership, he mobilizes Virchow's criticism of "natural healers" and homeopaths. With loving care is unearthed what Virchow, the anthropologist, had to say concerning the problematic character of dolichocephaly, the praiseworthy universalism of the Jews, the mongolic components of the so-called Aryans etc. Virchow, the medical historian, serves as a cover for the author's polemic against the ruling "constitutionalism" in Nazi medicine, against the Nazi cult of the exclusive training of the body. Through Virchow, the medical economist, we learn that Upper Silesia is ethnically Polish. And over and over again we are reminded through Virchow's mouth that internationalism, humanitarianism, and freedom are the true goals of science and education.

One has to remember for a moment the contents of Nazi ideology, the pitiless character of Nazi dictatorship, the moment of publication (1940—the second year of the war) in order to appreciate fully the importance of this little book as a historic document. It clearly shows that the ideological rubbish of the Nazis was by no means generally accepted, and that at least one outstanding German scientist was willing to defend at the risk of his life the historic truth and the defiled banner of German liberalism. In this sense the little book, intended as a monument for Rudolf Virchow, is no less a monument for Ludwig Aschoff. The doubts in the sincerity of Aschoff's liberal convictions which were sometimes raised during his lifetime, are definitely dispersed through his last book.

Though the book is primarily "propaganda," it is nonetheless historically true, as Virchow was indeed much more than just the inventor of the Zellularpathologie. The man whom Bismarck tried to liquidate by a challenge for a duel was one of the greatest liberal thinkers of the 19th century. With the small space at his disposal and with the goal of propagandizing in mind, the author has not bothered with the scanty literature on Virchow, including more recent historical work like that of Walter Pagel or myself, but limited himself to the development of his own

ideas, while rereading Virchow. This can be held even less against the author, as he was not at a loss for such ideas.

ERWIN H. ACKERKNECHT.

A Century of Butler Hospital, 1844-1944. Printed by authorization of The Board of Trustees under the direction of The Centennial Committee. Providence, R. I., 1944. iii + 49 pp., illustrated.

This handsomely printed and illustrated booklet (regardless of the apology contained therein which explains that the format was restricted by Federal wartime policy) is a most appropriate manner in which to commemorate the centennial of an institution. A hospital such as Butler Hospital in Providence, R. I. deserves to have its story recorded, just as an individual deserves a biography because of achievements and service to humanity.

This publication consists of three essays discussing the non-medical and medical aspects of Butler Hospital which throughout its existence has been one of the outstanding mental hospitals in this country. "A Layman's Narrative" by William Greene Roelker, Director of the Rhode Island Historical Society, is essentially a history of the Board of Trustees and of the financial transactions of the hospital, its gifts, the expansion of the physical plant, and similar details. Mr. Roelker has explored the Trustees' minutes very carefully and has brought out the salient facts. He shows conclusively that Francis Tiffany's account that it was Miss Dorothea Lynde Dix's persuasion which led Cyrus Butler to give $40,000 to the hospital is purely a myth.

The second essay by Dr. Arthur H. Ruggles, the present Superintendent at Butler, discusses his five predecessors under the title "The Achievements of Five Superintendents." Beginning with Dr. Isaac Ray, who for 22 years guided the institution and developed the pattern for its subsequent growth, Butler was fortunate to have the leadership of unusually capable men: Dr. John W. Sawyer, a disciple of Ray; Dr. William B. Goldsmith who unfortunately died two years after his appointment; Dr. William A. Gorton; and Dr. G. Alder Blumer. The work of the present Superintendent, Dr. Ruggles, is described in the concluding essay of the booklet entitled "The Closing of the Century" by Dr. Gregory Zilboorg, Associate Editor of the Centenary Volume of the American Psychiatric Association which also celebrated its 100th anniversary in 1944. A striking feature of the accounts of these Superintendents is that each one of them represents the most advanced type of physician for the mentally ill in his day. This undoubtly explains Butler's continuous record of preeminence in its field; in other words, it always kept up-to-date.

In my opinion one more chapter could agreeably have been included in this booklet, one that would have rounded out and completed the whole. That would have concerned itself with the actual individuals for whom the hospital was created and whom it served. In the various chapters we find only fleeting glimpses of the patients. From the point of view of the person who seeks information regarding the actual regime and treatment of patients at Butler Hospital, even in a general way, the present account does not help him. One would like to find

details concerning the daily routine of patients, pictures of their apartments, specific remarks about the treatment which was applied during the various periods of the hospital's history.

As the record in this booklet, the achievement of Butler Hospital has been a remarkable one, and the words of Mr. Walter A. Edwards, President of its Board of Trustees, show that its present leadership is aware of its responsibility to maintain the hospital's record: "The living owe it to the dead to adapt the latter's achievement to new conditions and to impart to it a continuing growth; for otherwise the achievement will prove as mortal as those who wrought it. Therefore at the end of a century, or at any other moment of time, the present's debt to the past cannot be paid; only in the future can payment be made."

GENEVIEVE MILLER.

CHARLES A. ELSBERG, M. D. *The Story of a Hospital: The Neurological Institute of New York, 1909-1938.* New York: London: Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, 1944. xii + 174 pp., illustrated. $3.50.

In 1938 the Neurological Institute of New York, founded twenty-nine years before as the first hospital in this country devoted entirely to the treatment and study of diseases of the nervous system, was amalgamated with the Presbyterian Hospital. The date of its founding coincides with the time when modern medical advances had necessitated further specialization. There were no institutions in the country where students seeking extensive training in neurology could go, nor where patients suffering from such diseases could be assured treatment by specialists. All that existed were a few out-patient clinics in general hospitals, but no specialized wards.

In 1909 three New York neurologists, Dr. Joseph Collins, Dr. Joseph Fraenkel, and Dr. Pearce Bailey, recognized the urgent need for such a hospital and founded the Neurological Institute of New York. At this same time they asked Dr. Charles Elsberg, the author of this book, to join them on the staff as a neurological surgeon. From a hospital of 82 beds in a modest 6 storey building, the Institute grew to a completely modern 14 storey structure which included complete facilities for research as well as treatment. It affiliated with the Columbia-Presbyterian Medical Center and became an integral part of the teaching program of the College of Physicians and Surgeons.

Throughout its existence it was supported financially by the generosity of the medical staff and interested lay friends, but the time came when the financial burden was too great to be borne alone, and at that time the amalgamation with Presbyterian Hospital took place.

Dr. Elsberg has given us a modest, straightforward account of an institution, in the success of which he undoubtedly played a large part.

GENEVIEVE MILLER.

ANDREW DENNY RODGERS III. *American Botany; 1873-1892, Decades of Transition.* Princeton: Princeton University Press, 1944. 340 pp. $3.75.

In 1940 Mr. Rodgers published his first study in the history of American botany. It was a biography of his grandfather William Sullivant (died 1873), an ardent student of mosses who, both aiding and aided by the renowned paleobotanist Leo Lesquereux, did pioneer work in American bryology.[1] This book, extremely readable and well documented, was soon followed by studies of John Torrey[2] and of John Merle Coulter.[3] Torrey was the leading pre-Darwin botanist in America. Devoting himself to description and classification, he prepared the way for the greatest of American botanists, Asa Gray, who accepted evolution, was alive to botanical progress the world over, and who encouraged the manifold growth of botany from simple classification to specialized experimental studies. Coulter was a botanist of the most recent period, dying in 1928, Torrey of the earliest, dying in 1873. The book we are here considering covers the transitional period between Torrey and Coulter, or, more exactly, from the death of Torrey in 1873 to the death of Gray in 1888.

The book is not a biography of the last years of Gray's life, though his guidance and encouragement of the many diverse personalities and activities in American botany of those years form the only thread of continuity through the maze of material Rodgers has gathered. Using as the chief source of material the botanists' own correspondence, which he quotes abundantly, Rodgers presents it in chronological order. In 1873 Gray, retiring from active teaching at Harvard, devoted himself to the University herbarium and its studies. He corresponded with botanists who pursued plant exploration as members of government surveys—Rothrock, Parry—and with individual collectors—Engelmann, Lesquereux, Greene—to name the more prominent of scores of whom Rodgers speaks and whose letters he quotes. Many of these men laid the foundations for botany's development into special fields which Rodgers touches upon at their inception, Rothrock and experimental botany, Lesquereux and paleobotany, Bailey and horticulture. By the time of Gray's death American botany was moving from the period of field exploration and was entering upon a new era in which botanists became laboratory specialists.

The book ably meets its author's claim in the Preface that it is an analytic and synthetic interpretation of American botany of the years 1873-92. Precisely because of its completeness describing the multitude of explorations, the very many workers, their relationships and accomplishments of those years, the book is hardly as readable as the other works of Rodgers in which he so well combines a genius for biography with solid studies in the history of botany. It is a book for readers interested in plants or in the men (many were practising physicians) who pioneered in American plant study. It is above all a book for historians of

[1] *"Noble Fellow" William Starling Sullivant*, New York: G. P. Putnam's Sons, 1940.
[2] *John Torrey, A Story of North American Botany*, Princeton: Princeton University Press, 1942.
[3] *John Merle Coulter, Missionary in Science*, Princeton: Princeton University Press, 1944.

American botany and is especially valuable for its research in the least accessible and the most perishable of source material, letters. These Rodgers has searched out the country over, making copies or photostating them, as he did also when preparing the biographies of Sullivant, Torrey, and Coulter. The history of botany in America has been greatly enriched by these studies. There are more to come,—a biography of Bernhard Fernow, which will constitute a history of forestry in this country (p. 109), and apparently also a biography of John Lemmon, a colorful California schoolmaster and pioneer botanist of the Far West (p. 135). By means of such books which are both scholarly historical studies and documents rich with vivid biographical sketches Rodgers is creating a fine monument to the men who have built American botany.

G. Raynor Thompson.

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